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ABSTRACT

The final report summarizes accomplishments of Project AEROBIC (Aerobic Exercise and Research Opportunities to Benefit Impaired Children), which provided a physical education exercise program for severely, profoundly, and multiply handicapped children aged 10-21. Activities are outlined for the 3 year period and include modification of exercise testing equipment, training of personnel, revision of curricular materials, and adaptation of instructional strategies. Formal, daily physical education progams were established to improve cardiovascular function based on assessment of movement limitation. It was concluded that the population does exhibit increased cardiovascular functioning following participation in a regularly scheduled program of motor activities. The bulk of the report consists of appendixes which include copies of the following papers by Richard Mulholland, Jr. and Alexander W. McNeill: "Cardiovascular Responses of Three Profoundly Retarded, Multiply-Handicapped Children during Selected Motor Activities"; "Consolidation Memory Theory Applied to Relearning Motor Skills in Severely/Profoundly Handicapped Children"; "The Effects of Systematic Ambulation Training on the Cardiovascular Responses of Severely/Profoundly Handicapped Children"; and "Heart Rate Responses of Profoundly Handicapped Children during Closed-Skill Fine Motor and Open-Skill Gross Motor Activities." (CL)

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Final Report

Aerobic Exercise and Research
Opportunities to Benefit Impaired
Children

(Project AEROBIC)

University of Idaho, Moscow

Grant No. G008102717

CFDA: 84. 023C

Special Education Programs, Washington, DC

EC172584

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PROGRAM NARRATIVE

Project Objectives

The following objectives describe the research, demonstration, and training component activities for the project involving Aerobic Exercise and Research Opportunities to Benefit Impaired Children (Project AEROBIC).

1.0 Research the possible assessment, objectives, and training procedures which can be used with severely and profoundly handicapped children ages 10-21 years.

  1.1 Modify equipment and procedures for measuring cardiorespiratory fitness to be appropriate for use with severely and profoundly handicapped children.
  1.2 Develop a curriculum for a hierarchy of skill objectives for developing increasing levels of cardiorespiratory fitness in severely and profoundly handicapped children.
  1.3 Determine the instructional strategies which effectively provide for increases in the cardiorespiratory fitness of severely and profoundly handicapped children.
  1.4 Evaluate the effectiveness of the instrumentation, curriculum and instructional strategies for measurement and training in cardiorespiratory fitness and its effect upon self-help, social, and academic functioning.

2.0 Provide a physical education exercise program for severely and profoundly handicapped children, which utilizes the curriculum and strategies being developed for cardiorespiratory fitness, as a model demonstration program for state institutions and public schools.

  2.1 Provide training for awareness of the environment.
  2.2 Provide training for object control.
  2.3 Provide training for locomotor movement and skills.

3.0 Provide inservice training for teachers and support personnel directly involved in the research and exercise program for Project AEROBIC.

  3.1 Train teachers to use the equipment and procedures necessary for data collection in component 1.0.
  3.2 Train teachers to utilize the curriculum and instructional strategies in order to provide the physical education exercise program.
  3.3 Monitor data collection and training within the exercise program to assure proper use of methodology.

4.0 Administratively, it will be an objective of Project AEROBIC to disseminate findings from the research and exercise program. This will be accomplished by presentations at conferences and submission of articles for publication. The curricular materials developed by Project AEROBIC will be submitted to the Marketing Task Force of the Bureau of Education for the Handicapped to determine suitability of the materials for commercial distribution, as arranged by the Market Linkage Project for Special Education, LINC Services, Inc.

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A timetable for accomplishing these objectives is outlined below:

Year One

A. Modify exercise testing equipment and protocols suitable for use in the evaluation of the cardiorespiratory function of severely handicapped children, in particular the multi-handicapped. Obtain measures of reliability and validity.

B. Obtain baseline data of movement abilities and physiological functioning for subject population and compare to other studies and curricular hierarchies. Develop a lattice of movement skills leading from low level basic movement, such as tracking, reaching, and grasping, to high level aerobic activities, such as bicycling (with hand or foot pedals), swimming, and running. Collect data on effects of instructional strategies.

C. Train support personnel in the use of simple testing equipment, testing protocols, and teaching procedures for using the curricular materials.

Year Two

A. Continue to modify equipment and protocols as needed. Test subjects on cardiorespiratory functioning.

B. Begin formal exercise program with ongoing data collection. Continue personnel training as needed and monitor progress.

C. Refine and expand the lattices as needed, based on results midway through the second year.

Year Three

A. Increase the population in Idaho for testing and training with the revised curricular materials.

B. Develop more options and adaptions of instructional strategies and exercise programs, based upon the results from Year Two. Continue data collection.

C. Establish liaison with institutions and schools in nearby states for replication of program results. Begin training of personnel.

D. Submit the exercise program to the National Diffusion Network for national distribution and validation.

E. Submit the curricular materials for publication.

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Accomplishments

As indicated in our continuing report for year 3, we were experiencing some difficulty in implementing the program at the Idaho State School for the Deaf and the Blind. I am pleased to report that our strategy of placing Richard Mulholland at this institution has been entirely successful. Mr. Mulholland implemented programming for the profoundly retarded, multiply-handicapped children enrolled at this institution. The orderly manner in which Mr Mulholland developed his programming and maintained his records have been responsible, in large part, for the successful completion of this project.

We had indicated in our second year report that the programming at our other site at the Idaho State School and Hospital was going through its first major evolutionary step. Unfortunately, the individual who was responsible for the programming at the Idaho State School and Hospital resigned to assume a position that was more profitable. Although we immediately replaced this individual with another qualified project manager, the programming at this institution did not show a concomitant growth with that at the Idaho State School for the Deaf and the Blind. Professionals working in residential institutions are very protective about the children with whom they work. It was necessary for us to give the Idaho State School and Hospital sufficient time to develop an effective degree of cooperation with this new project manager. As a result, Mr. Mulholland and myself elected to spend the majority of our efforts collecting data from the Idaho State School for the Deaf and the Blind, while maintaining the degree of programming in effect at the Idaho State School and Hospital. Hence, the majority of the data used in the four papers presented in Appendix A, were collected at the Idaho State School for the Deaf and the Blind. As programming and data collection techniques were developed and refined at the Idaho State School for the Deaf and the Blind, details of this development were shared with the individual at the Idaho State School and

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Hospital.

Overall, we believe that our project has been extremely successful. The work that was conducted at the two sites in Idaho has resulted in a great deal of visibility being given to motor programming for severely or profoundly retarded, multiply-handicapped children. As a result of our inability to obtain appropriate electronic instrumentation for directly measuring oxygen and carbon dioxide concentrations, the metabolic measures used in this project were, necessarily, indirect. While we feel that we have made a significant contribution regarding the physiological responses of severely or profoundly retarded, multiply handicapped children, it is still necessary to pursue direct metabolic measures from these subjects. After three years working with this population, it is our considered opinion, that such direct metabolic measures are indeed possible, but will require the investment of considerable financial resources which were beyond the scope of Project AEROBIC. Although we had anticipated many of the problems that we would encounter while working with these children, we encountered many others which were several orders of magnitude greater than those anticipated in the original proposal. The children with whom we worked, although adequately described by the term severely or profoundly retarded, and multiply-handicapped, all exhibited individual differences which necessitated treating them in a single subject design protocol. It is our considered opinion that it is not appropriate to treat data from this population as group data, and that future experiments that uses severely or profoundly retarded and multiply-handicapped children be designed as single subject experiments.

On page six of our third year continuation request, we presented plans for accomplishing project objectives. Specifically we accomplished the following:

1. Baseline data were collected for all of our subjects in the late fall of 1983 and the early spring of 1984. Routine evaluation of programming effectiveness

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continued throughout the second and third year. The data collected at this time were used to develop the papers presented in Appendix A.

2. Formal, daily physical education programs were established for the project subjects at the Idaho State School and Hospital, and at the Idaho State School for the Deaf and the Blind in Gooding. Each child involved in Project AEROBIC was assessed concerning their individual movement limitations, and a program of physical activity developed to influence his/her cardiorespiratory functioning. Although data concerning the effectiveness of this programming was only collected at the Idaho State School for the Deaf and the Blind, based on the results achieved at this location, we feel confident that the programming at the Idaho State School and Hospital was similarily effective.

3. Presentation of programming developed, and data collected during the programming period were presented at the State meetings of the Idaho Association of Health, Physical Education and Recreation, and the Idaho Council for Exceptional Children, during the years 1982, 1983 and 1984. A presentation of selected data and programming was also presented at the National meeting of the Council for Exceptional Children in Washington D.C. in the spring of 1984. Four publications have also been developed and submitted to appropriate professional journals; they are included in Appendix C. We will continue to evaluate our data and develop additional materials for dissemination over the next few years.

4. The total programming concept has been developed in the form of a video tape and has been submitted to LINC Resources, Incorporated for additional development and for national distribution.

Summary

The single most significant finding of this study is that severely or profoundly retarded, multiply handicapped children do exhibit increased cardiovascular functioning following participation in a regularly scheduled program of motor activities. Each child must have his/her programs specially designed for his/her specific handicapping conditions; both fine motor and gross motor skills appear to illicit significant heart rate responses depending upon the level of functioning of the child.

During the last year of the study, a specially designed bicycle ergometer was fabricated at the Idaho State School for the Deaf and the Blind. It was designed to allow the pedal cranks to be operated from a semi-reclining position. However, the motor patterns required to move the feet and the pedals appeared to be beyond the level of motor functioning of the subjects in this study (with more time it might be possible to develop appropriate motor engrams).

We would like to acknowledge the support and encouragement extended to the Project by the staff, faculty and administration of the Idaho State School and Hospital, and the Idaho State School for the Deaf and the Blind, without their support this study would not have been possible. We would also like to express our gratitutde to the U. S. Office of Education, especially to Ms. Gloria Johnson and Dr. Allen Dittman for their support and encouragement throughout the project.

Presentations of Findings

1982 - Idaho Association of Health, Physical Education and Recreation, Pocatello, ID

1983 - Idaho Association of Health, Physical Education and Recreation, Boise, ID

- Idaho Council for Exceptional Children, Pocatello, ID

1984 - Idaho Association of Health, Physical Education and Recreation, Moscow, ID

- Idaho Council for Exceptional Children, Pocatello, ID

- National Council for Exceptional Children, Washington, D.C.

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Papers (Copies of the papers are presented in Appendix C)

"Cardiovascular Responses of Three Profoundly Retarded, Multiply-Handicapped Children During Selected Motor Activities"

Accepted for Pbulication, Adapted Physical Activity Quarterly.

"The Effects of Systematic Ambulation Training on the Cardiovascular Responses of Severely/Profoundly Handicapped Children".

Submitted to: J. Association of the Severely Handicapped

"Consolidation Memory Theory Applied to Relearning Motor Skills in Severely/Profoundly Handicapped Children".

Submitted to: J. Applied Behavior Analysis

"Heart Rate Responses of Profoundly Handicapped Children during Closed-skill Fine Motor and Open-Skill Gross Motor Activities".

Submitted to: American Journal of Mental Deficiency

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Videotaped Curriculum Activities

Submitted to L.I.N.C. Resources.

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Appendix A

2nd Year Continuing Report

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OMB Approval No. 29–RO218

FEDERAL ASSISTANCE

1. TYPE OF ACTION (Mark appropriate box)
☐ PREAPPLICATION
☒ APPLICATION
☐ NOTIFICATION OF INTENT (Opt.)
☐ REPORT OF FEDERAL ACTION

2. APPLICANT'S APPLICATION
a. NUMBER
b. DATE Year month day 19 82 07 23

3. STATE APPLICATION IDENTIFIER
a. NUMBER
b. DATE ASSIGNED Year month day 19

Leave Blank

SECTION I—APPLICANT/RECIPIENT DATA

4. LEGAL APPLICANT/RECIPIENT
a. Applicant Name : University of Idaho
b. Organization Unit : Division H.P.E.R
c. Street/P.O. Box :
d. City : Moscow
e. County : Latah
f. State : Idaho
g. ZIP Code: 83843
h. Contact Person (Name & telephone No.) : Dr. Alex McNeill 208-885-7921

5. FEDERAL EMPLOYER IDENTIFICATION NO. 826-000-945

6. PROGRAM (From Federal Catalog)
a. NUMBER 8 4 • 0 2 3 C
b. TITLE Handicapped - Field Initiated Research

7. TITLE AND DESCRIPTION OF APPLICANT'S PROJECT
AEROBIC Exercise and Research Opportunities to Benefit Impaired Children

8. TYPE OF APPLICANT/RECIPIENT
A–State
B–Interstate
C–Substate District
D–County
E–City
F–School District
G–Special Purpose District
H–Community Action Agency
I–Higher Educational Institution
J–Indian Tribe
K–Other (Specify):
Enter appropriate letter I

9. TYPE OF ASSISTANCE
A–Basic Grant
B–Supplemental Grant
C–Loan
D–Insurance
E–Other
Enter appropriate letter(s) A

10. AREA OF PROJECT IMPACT (Names of cities, counties, States, etc.)
Idaho and N. Utah

11. ESTIMATED NUMBER OF PERSONS BENEFITING

12. TYPE OF APPLICATION
A–New
B–Renewal
C–Revision
D–Continuation
E–Augmentation
Enter appropriate letter D

13. PROPOSED FUNDING

a. FEDERAL	$ 83257	.00
b. APPLICANT	6108	.00
c. STATE		.00
d. LOCAL		.00
e. OTHER		.00
f. TOTAL	$ 89365	.00

14. CONGRESSIONAL DISTRICTS OF:
a. APPLICANT Latah
b. PROJECT Latah

15. TYPE OF CHANGE (For 12c or 12e)
A–Increase Dollars
B–Decrease Dollars
C–Increase Duration
D–Decrease Duration
E–Cancellation
F–Other (Specify):
Enter appropriate letter(s)

16. PROJECT START DATE Year month day 19 82 10 1

17. PROJECT DURATION 36 Months

18. ESTIMATED DATE TO BE SUBMITTED TO FEDERAL AGENCY ▶ Year month day 19 82 07 26

19. EXISTING FEDERAL IDENTIFICATION NUMBER G008102717

20. FEDERAL AGENCY TO RECEIVE REQUEST (Name, City, State, ZIP code)
U.S. Department of Education, Application Control Center, Washington, D.C. 20202

21. REMARKS ADDED ☐ Yes ☐ No

SECTION II—CERTIFICATION

22. THE APPLICANT CERTIFIES THAT ▶
a. To the best of my knowledge and belief, data in this preapplication/application are true and correct, the document has been duly authorized by the governing body of the applicant and the applicant will comply with the attached assurances if the assistance is approved.
b. If required by OMB Circular A–95 this application was submitted, pursuant to instructions therein, to appropriate clearinghouses and all responses are attached:

	No response	Response attached
(1)	☐	☐
(2)	☐	☐
(3)	☐	☐

23. CERTIFYING REPRESENTATIVE
a. TYPED NAME AND TITLE Gerald Reynolds, Controller
b. SIGNATURE
c. DATE SIGNED Year month day 19

SECTION III—FEDERAL AGENCY ACTION

24. AGENCY NAME

25. APPLICATION RECEIVED Year month day 19

26. ORGANIZATIONAL UNIT

27. ADMINISTRATIVE OFFICE

28. FEDERAL APPLICATION IDENTIFICATION

29. ADDRESS

30. FEDERAL GRANT IDENTIFICATION

31. ACTION TAKEN
☐ a. AWARDED
☐ b. REJECTED
☐ c. RETURNED FOR AMENDMENT
☐ d. DEFERRED
☐ e. WITHDRAWN

32. FUNDING

a. FEDERAL	$	.00
b. APPLICANT		.00
c. STATE		.00
d. LOCAL		.00
e. OTHER		.00
f. TOTAL	$	.00

33. ACTION DATE ▶ Year month day 19

34. STARTING DATE Year month day 19

35. CONTACT FOR ADDITIONAL INFORMATION (Name and telephone number)

36. ENDING DATE Year month day 19

37. REMARKS ADDED ☐ Yes ☐ No

38. FEDERAL AGENCY A–95 ACTION
a. In taking above action, any comments received from clearinghouses were considered. If agency response is due under provisions of Part 1, OMB Circular A–95, it has been or is being made.
b. FEDERAL AGENCY A–95 OFFICIAL (Name and telephone no.)

ED Form 9037, 6/80 (CFDA #84.023)

STANDARD FORM 424 PAGE 1 (10–75)
Prescribed by GSA, Federal Management Circular 74–7

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SECTION IV—REMARKS *(Please reference the proper item number from Sections I, II or III, if applicable)*

NOTE: If person responsible for grant negotiations is different from person named in Item 4h. please identify by name and phone number in this space.

name: ______________________________

phone: ______________________________
(area code) (number) (extension)

PART II
PROJECT APPROVAL INFORMATION

ITEM 1.
Does this assistance request require State, local, regional, or other priority rating?
☐ Yes ☐ No

Name of Governing Body ____________
Primary Duties ____________

ITEM 2.
Does this assistance request require State, or local advisory, educational or health clearances?
☐ Yes ☐ No

Name of Agency or Board ____________
(Attach Documentation)

ITEM 3.
Does this assistance request require clearinghouse review in accordance with OMB Circular A-95?
☐ Yes ☐ No

(Attach Comments)

ITEM 4
Does this assistance request require State, local, regional, or other planning approval?
☐ Yes ☐ No

Name of Approving Agency ____________
Date ____________

ITEM 5
Is the proposed project covered by an approved comprehensive plan?
☐ Yes ☐ No

Check one:
☐ State
☐ Local
☐ Regional
Location of Plan ____________

ITEM 6
Will the assistance requested serve a Federal installation?
☐ Yes ☐ No

Name of Federal Installation ____________
Federal Population benefiting from Project ____________

ITEM 7
Will the assistance requested be on Federal land or installation?
☐ Yes ☐ No

Name of Federal Installation ____________
Location of Federal Land ____________
Percent of Project ____________

ITEM 8
Will the assistance requested have an impact or effect on the environment?
☐ Yes ☐ No

See instructions for additional information to be provided.

ITEM 9
Will the assistance requested cause the displacement of individuals, families, businesses, or farms?
☐ Yes ☐ No

Number of:
Individuals ____________
Families ____________
Businesses ____________
Farms ____________

ITEM 10
Is there other related assistance on this project previous, pending, or anticipated?
☐ Yes ☒ No

See instructions for additional information to be provided.

OMB APPROVAL NO. 29-R0218

PART III – BUDGET INFORMATION

SECTION A – BUDGET SUMMARY

GRANT PROGRAM, FUNCTION OR ACTIVITY (a)	FEDERAL CATALOG NO. (b)	ESTIMATED UNOBLIGATED FUNDS		NEW OR REVISED BUDGET		
		FEDERAL (c)	NON-FEDERAL (d)	FEDERAL (e)	NON-FEDERAL (f)	TOTAL (g)
1. Field initiated Research Handicapped	84023C	$ None	$	$ 83257	$	$
2.						
3.						
4.						
5. TOTALS		$	$	$ 83257	$	$

SECTION B – BUDGET CATEGORIES

6. OBJECT CLASS CATEGORIES	GRANT PROGRAM, FUNCTION OR ACTIVITY				TOTAL
	(1)	(2)	(3)	(4)	(5)
a. PERSONNEL	$ 44226	$	$	$	$
b. FRINGE BENEFITS	7892				
c. TRAVEL	3700				
d. EQUIPMENT					
e. SUPPLIES	2000				
f. CONTRACTUAL					
g. CONSTRUCTION					
h. OTHER	4500				
i. TOTAL DIRECT CHARGES	62318				
j. INDIRECT CHARGES	20939				
k. TOTALS	$ 83257	$	$	$	$
7. PROGRAM INCOME	$	$	$	$	$

HEW-608T

OMB APPROVAL NO. 29-R0218

SECTION C – NON-FEDERAL RESOURCES

(a) GRANT PROGRAM	(b) APPLICANT	(c) STATE	(d) OTHER SOURCES	(e) TOTALS
8.	$	$	$	$
9.				
10.				
11.				
12. TOTALS	$	$	$	$

SECTION D – FORECASTED CASH NEEDS

	TOTAL FOR 1ST YEAR	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
13. FEDERAL	$	$	$	$	$
14. NON-FEDERAL					
15. TOTALS	$	$	$	$	$

SECTION E – BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) GRANT PROGRAM	FUTURE FUNDING PERIODS (years)			
	(b) FIRST	(c) SECOND	(d) THIRD	(e) FOURTH
16. Handicapped: Field initiated research	$ 96,327	$	$	$
17.				
18.				
19.				
20. TOTALS	$	$	$	$

SECTION F – OTHER BUDGET INFORMATION (attach additional sheets if necessary)

21. DIRECT CHARGES: See budget explanation

22. INDIRECT CHARGES: Based upon a rate of 33.6% of direct charges

23. REMARKS:

PART IV – PROGRAM NARRATIVE (attach per instructions)

Budget explanations cont.	Year 1	Year 2	Year 3
Supplies			
Metals, electronic supplies, tools, electrodes etc. for adapting equipment for use with handicapped; paper and office supplies		$2000	$2200
Other			
Consultant - Richard Mulholland is now at the University of Utah. His continued participation in the project is vital. We request that the monies originally described for summer employment be used for consulting fees as follows: Each trip: Two days consultation inclusive of travel and per diem =$370 (Round trip air fare from Salt Lake City to Boise is $210) Mr. Mulholland will make these trips 10 times in such a way that we can achieve maximum supervision of the project.		$3700	$4500
Totals			
Direct costs		$62318	$72101
Indirect costs		$20939	$24225
		$83257	$96327

BUDGET EXPLANATIONS

	Year 1	Year 2	Year 3
Personnel			
Project Director Summer employment. During academic year, .25 of his salary will be an in kind contribution.		$6260	$6293
Laboratory Assistant		$8190	$9910
Project managers (full-time) 12 mth. appointment		$28000	$30800
Clerical help (625 hours at $3.60/hour)		$1776	$2723
Fringe Benefits			
Project Director		$1315	$1322
Laboratory assistant		$573	$694
Project managers (Fringe benefits for the above: Group Life Insurance, Group Health Insurance, Workmens Compensation, Retirement, Employment Security, Social Security (FICA), Disability Income)		$5880	$6468
Irregular help (Fringe benefits: Social Security, Workmens Compensation, Employment Security)		$124	$191
Travel		$3700	$5500

Travel to Nampa and Gooding
(Both of these towns are accessed through Boise)

Air fare round trip Moscow-Boise	$170.50
Lodging (two nights)	$ 84.00
Car rental (three days/trip)	$163.00
Per diem $15 for 3 days	$ 45.00
total per trip	$462.50
Eight trips for data collection and program supervision	$3700

	Year 1	Year 2	Year 3
Printing materials (testing materials)		$100	$400
Communications (long distance telephone)		$700	$1100
Physical Plant services (All machining is done by the physical plant, the bulk of this is already completed, the $700 represents primarily telephone			

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University of Idaho
Division of Health, Physical
Education, Recreation and Dance
Physical Education Bldg.
Moscow, Idaho/83843
Phone (208) 885-7921

Gloria Johnson
Department of Education
Room 5715
ROB #3
400 Maryland Ave
Washington D.C.
20202

Dear Ms. Johnson : 26 July 1982

Please find enclosed the revised budget for the second year of project A.E.R.O.B.I.C. The changes have been made in accordance with your instructions.

Making the changes in the travel has reduced the supervision that will be possible at the two locations for the project this year; however, by spreading the supervision visits with the consultations we will maximize our contacts with the project directors.

Sincerely,

Alexander W. McNeill Ph.D.

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PROGRAM NARRATIVE

Project Objectives

The following objectives describe the research, demonstration, and training component activities for the project involving Aerobic Exercise and Research Opportunities to Benefit Impaired Children (Project AEROBIC).

1.0 Research the possible assessment, objectives, and training procedures which can be used with severely and profoundly handicapped children ages 10-21 years.
  1.1 Modify equipment and procedures for measuring cardiorespiratory fitness to be appropriate for use with severely and profoundly handicapped children.
  1.2 Develop a curriculum for a hierarchy of skill objectives for developing increasing levels of cardiorespiratory fitness in severely and profoundly handicapped children.
  1.3 Determine the instructional strategies which effectively provide for increases in the cardiorespiratory fitness of severely and profoundly handicapped children.
  1.4 Evaluate the effectiveness of the instrumentation, curriculum and instructional strategies for measurement and training in cardiorespiratory fitness and its effect upon self-help, social, and academic functioning.

2.0 Provide a physical education exercise program for severely and profoundly handicapped children, which utilizes the curriculum and strategies being developed for cardiorespiratory fitness, as a model demonstration program for state institutions and public schools.
  2.1 Provide training for awareness of the environment.
  2.2 Provide training for object control.
  2.3 Provide training for locomotor movement and skills.

3.0 Provide inservice training for teachers and support personnel directly involved in the research and exercise program for Project AEROBIC.
  3.1 Train teachers to use the equipment and procedures necessary for data collection in component 1.0.
  3.2 Train teachers to utilize the curriculum and instructional strategies in order to provide the physical education exercise program.
  3.3 Monitor data collection and training within the exercise program to assure proper use of methodology.

4.0 Administratively, it will be an objective of Project AEROBIC to disseminate findings from the research and exercise program. This will be accomplished by presentations at conferences and submission of articles for publication. The curricular materials developed by Project AEROBIC will be submitted to the Marketing Task Force of the Bureau of Education for the Handicapped to determine suitability of the materials for commercial distribution, as arranged by the Market Linkage Project for Special Education, LINC Services Inc.

A timetable for accomplishing these objectives is outlined below:

Year One

A. Modify exercise testing equipment and protocols suitable for use in the evaluation of the cardiorespiratory function of severely handicapped children, in particular the multi-handicapped. Obtain measures of reliability and validity.

B. Obtain baseline data of movement abilities and physiological functioning for subject population and compare to other studies and curricular hierarchies. Develop a lattice of movement skills leading from low level basic movement, such as tracking, reaching, and grasping, to high level aerobic activities, such as bicycling (with hand or foot pedals), swimming, and running. Collect data on effects of instructional strategies.

C. Train support personnel in the use of simple testing equipment, testing protocols, and teaching procedures for using the curricular materials.

Year Two

A. Continue to modify equipment and protocols as needed. Test subjects on cardiorespiratory functioning.

B. Begin formal exercise program with ongoing data collection. Continue personnel training as needed and monitor progress.

C. Refine and expand the lattices as needed, based on results midway through the second year.

Year Three

A. Increase the population in Idaho for testing and training with the the revised curricular materials.

B. Develop more options and adaptations of instructional strategies and exercise programs, based upon the results from Year Two. Continue data collection.

C. Establish liaison with institutions and schools in nearby states for replication of program results. Begin training of personnel.

D. Submit the exercise program to the National Diffusion Network for national distribution and validation.

E. Submit the curricular materials for publication.

Accomplishments

1. a) We have designed and built a small audio amplifier for use in monitoring heart rate from non-ambulatory subjects. This is to be used in the rotary and tilting activities described on page 23 of the original proposal.

   b) This same device can be used as direct feedback for higher functioning residents as they particpate in activities.

   c) The device is powered by two small 3.5 volt mercury cells and may be used with waterproof electrodes to monitor heart rate changes during hydro therapy and exercise.

2. We have designed a system using E.C.G. telemetry equipment to monitor the standard V_4 electrocardiogram of residents who may never have been exposed to any form of cardiorespiratory stimulation.

3. We have built a large water tank in the laboratory that will be used during the remainder of this project period to evaluate the metabolic changes that can be induced in cerebral palsied and other more severely handicapped children using standard, open circuit respirometry.

4. We anticipate that we will be able to provide a gas analysis system for use in the residential institutions for the beginning of the second year of the project.

5. The initial phase of this project was concerned, primarily, with the identification of instructional methodologies possessing the potential to increase cardiorespiratory functioning in severely/profoundly handicapped children. This process has resulted in formulation of several instructional packages, each appearing to possess the potential to create the desired physiological changes in the children participating in this project. However, because of the diverse needs and abilities of the severely/profoundly handicapped child, we have found it necessary to develop a screening and placement process that would allow for the effective matching of children with activities possessing the greatest potential for success concerning increases in their levels of cardio-respiratory functioning.

   A. Type of disorder and level of involvement.
      Type I Child - diagnosed cerebral palsy (spastic or athetosis), paraplegia.
      Type II Child - micro-cephaly and concomitant delays in neuro-motor development, marked flaccidity.
      Type III Child - ataxic disorders requiring great amounts of assistance and support.
      Each of the above classifications may be viewed as including a sample of children from the severely/profoundly handicapped population. Activities appropriate for each general classification are identified and matched with the individual child. Although this screening process may match a child with several activities, we can assume that only one may prove successful.

   B. Utilizing the above screening guidelines the following are a few examples of the programming techniques to be used in the piloting of the instructional strategies and equipment.
      1. Type I Child - severely and profoundly retarded, diagnosed athetosis cerebral palsy paraplegia, responsive to simple verbal commands.
         Equipment: one three-wheeled cycle with interchangeable gear sprockets permitting the workload to be modified. The bicycle is adapted so it may be pedaled by hand. An ortho-plastic grip designed in the form of a gauntlet, is attached to the pedals and the child's hands are placed into the apparatus. Heart rate will be monitored using the auditory monitor described earlier.
         Procedure - the child is motivated by the therapist to pedal the bicycle at an arbitrary rate, while the therapist monitors changes in heart rate at 15 second intervals. The activity is stopped when the desired work has been performed. If the workload does not produce adequate change in heart rate,

changes in the gear sprochet will allow for manipulation of such factors as resistance and pedal speed.

2. Type II Child - severely and profoundly retarded, flaccid musculature, non-responsive to verbal commands.
   Equipment:1 stationary three wheeled cycle adapted for hand pedaling with a variable speed motor drive attached to the pedal mechanism. Ortho-plastic grips designed in the form of gauntlet attached to pedals. One auditory heart rate monitor.
   Procedure - The child's hands are placed in the ortho-plastic gauntlet grips. The motor drive turns the pedals, while the therapist monitors the heart rate at 15 second intervals. The therapist can alter the workload by manipulating the variable speed drive to the pedals.

3. Type III Child - severely and profoundly retarded, delayed motor development, ambulation with assistance, responsive to simple verbal commands.
   Equipment: Four point walker modified by the attachment of a diaper-like apparatus serving to support and stabilize the child. Wheel casters with 360 degree rotation are attached to the weight bearing points of the walker. One auditory heart rate counter.
   Procedure - Child is placed in the walker apparatus. Therapist stands in front of the child and utilizes the necessary prompts and/or reinforcements to motivate the child to move forward with the walker. During this time the therapist monitors the child's heart rate on the 15 second schedule until the desired heart rate range is achieved. The therapist, using this auditory feedback process, can alter the pace of the activity in order to keep the child's heart rate in the appropriate range.

Instructional strategies mentioned are illustrative, and not to be considered an all-inclusive program. As mentioned earlier, each severely/profoundly handicapped child may be viewed as unique in character, abilities, and needs. The individual differences of each child may, as a result, require individual programming techniques. It seems reasonable to assume that a sample of ten children may require as many as seven or eight different intervention strategies.

6. The job description for individuals working as project directors in institutions has been identified as follows: candidates should have a master's degree in physical education with the following areas of emphasis:

   1. special populations,preferably the severely profoundly handicapped.
   2. behavior modification including data collection, reinforcement schedules, and reward identification.
   3. graduate level preparation in some form of exercise science.

   The candidate must have documented experience with severely profoundly handicapped children.

   Women and minorities are encouraged to apply.

Plans

The timetable for accomplishing project objectives is presented on page 2. Equipment modification and protocol development will continue as shown below:

1. Adapt respired air collection technology to meet the specific needs of specific handicaps. (Existing mouthpices are not appropriate for individuals with Down's Syndrome, or individuals with various forms of cerebral palsy.)

2. Modify an electromagnetically-brake bicycle ergometer for handicapping conditions involving general disequilibrium.

3. Modify the ergometer to avoid both flexion and extension reflexes encountered by the spastic forms of cerebral palsy. (This essentially means altering the position and shape of the bicycle handlebars and the position of the subjects head during the test.)

4. Adapt the ergometer for use with wheelchair subjects.

5. Establish exercise testing protocol that will permit cardiorespiratory evaluation of severely handicapped children.

A formal, daily physical education program will be established at each project site. The AEROBIC Program will explore programming as previously discussed. Each child participating in the program will be given an assessment of movement behavior, based upon the skill hierarchy of the curriculum, and an assessment of cardiorespiratory functioning. The assessments will be conducted in accordance with the due process and evaluation procedures required by Public Law 94-142. Students who are potentially "at risk" from the testing will not be assessed; or they will be included in the program with a physician's approval. An individualized education program (IEP) will be developed through a team meeting for each child. Appropriate goals and objectives from the AEROBIC curriculum will be assigned to each child, based upon the results of the assessments. Selection of an exercise program for initial placement will be determined through consideration of each child's location on the lattices of skills, their general level of assistance needed, and the type of reinforcement required.

Each exercise program will be divided into treatment phases individualized for each child. The children will begin with a baseline phase at the beginning of the school year. The baseline treatment, a structured play environment with no direct instruction by the teacher and only generalized social praise from the teacher, will last for two weeks and then will be alternated with each treatment phase. When alternating and exploring treatments, the baseline treatment will be used only for one week at a time. The experimental treatments will differ as to level of assistance, type of reinforcement, and philosophical approach (e.g., neurodevelopmental, sensory-motor, operant, etc.)

Evaluation of the effects of the exercise program will be made by tabulating the number of weeks of accelerated skill development to determine the percentage of success in comparison to total number of weeks of experimental treatments. Success rates will also be determined for each kind of assistance, reinforcement, and approach. The rates of success will be scored for individual children and for groups of children. The number of skill objectives achieved by each child will also be used as a criterion for evaluation. The goal will be to achieve twelve objectives per year, or an average of one per month. A learning rate of less than half of the stated goal will be an indication that either: 1) ineffective treatments were being used and should be eliminated from the exercise program, or 2) skill performance criteria were not established in small enough steps for a high learning rate. These evaluations will be used in conjunction with the regular physiological testing to facilitate revisions in the exercise program and in the curriculum guide.

Information on the exercise testing equipment and procedures will be presented at professional conferences, such as the National Conference on Physical Activity for Exceptional Individuals, and the American Alliance for Health, Physical Education and Recreation. At least one article will be submitted for journal publication. Information on the most effective approaches and strategies used in the exercise program will be disseminated in journal articles, newsletters, and presentations at state, regional, and national conferences.

We view the dissemination of our findings as an essential component of accountability and ask that our travel be supported as requested so that we might contribute through attendance at LINC Services workshops and professional meetings.

APPENDIX A

ISSH #1005

IDAHO STATE SCHOOL AND HOSPITAL **DATE:** 3-4-83

TO: Steve Van Atter, D.S., CME
Rik Mayfield, Proj. Mgr., AEROBICS Grant

FROM: Diane Helton, D.S., VIP

SUBJECT: Creative Movement Experience Programs

We have noticed growth in many of our visually impaired clients as they participate in CME. Several of our clients with limited ambulation have experienced success in moving themselves. You've tailored activities to meet each individuals physical and emotional needs and helped everyone to participate.

Your program has been an important part of our clients' experience at Ramsay Training Center.

Also, a special thanks on behalf of Bill A. You've made great progress with his motor coordination, auditory location, can use, and self-esteem.

Thank you for all the extra effort on behalf of our clients.

Diane Helton, DS
Diane Helton, D.S.

DH/bk

cc: Personnel file
Betty Standley, Supervisor
Alex McNeill, Ph.D.
University of Idaho

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APPENDIX B

INTRODUCTION

Purpose

I am seeking financial assistance to purchase one piece of equipment for our "Project AEROBIC: Aerobic Exercise and Research Opportunities to Benefit Impaired Children" G0081022717. The need for this support is presented in the following pages. The equipment that is being requested is a Beckman MMC Horizon Systems. It is an instrument that will measure quickly and unobtrusively all of the metabolic, pulmonary and nutritional parameters cited in the original study. It is portable, extremely sensitive and with small modifications well suited for use with the severely/profoundly handicapped children that comprise the population for Project AEROBIC.

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NEEDS STATEMENT

Historically, the Bureau has been reluctant to fund requests for capital outlay in the form of equipment purchases. This proposal requests that competition 84.029K considers the unique aspects of the presently funded project AEROBIC (Aerobic Exercise and Research Opportunities to Benefit Imparied Children) and facilitate the data collection process by funding this request for the purchase of a major piece of equipment.

There can be no question that the need exists for special physical education for severely/profoundly, multiply-handicapped children, especially for those children where the involvement is so great that institutionalization is virtually mandatory. The need for such programming is addressed in the text of Project AEROBIC. At the recent SEP/DPP/TADS meeting (December 1982) in Washington D.C., the Director of SEP addressed the issue of "Quality and Leadership in Special Education Personnel Preparation". I believe that the text of his speech recognizes the need for a reconsideration of historical practices. There follows a presentation of congruent goals for SEP and Project AEROBIC.

"It appears that our society is being gradually transferred from a centralized society to one based upon principals of decentralization...the responsibility for designing blueprints for the future are [SIC] becoming more widely distributed. I think this is an opportunity which we must actively pursue" (Sontag, December, 1982). Project AEROBIC is a model of a state taking responsibility for designing a blueprint for the future. In this case the model is for special physical education for institutionized deaf or blind children, as well as children who are both deaf and blind. As the project continues programming will be developed for children in less regulated environments. Work is progressing in these areas within Project AEROBIC at the Idaho State School and Hospital, Nampa, Idaho; and at the Idaho State School for the Deaf and Blind in Gooding, Idaho. In the present political climate there can be no denying the shift from a centralized control of educational practices to one where state and local agencies are responsible. The historical practices of the Bureau supporting programming and in-service training for special educators has sent unmistakeable, although perhaps unintentional, signals to foundations and other nonprofit agencies that support educational opportunities for handicapped children. As a result of which these agencies have adopted guidelines for supporting projects involving handicapped children that reflect the philosophical position taken by leaders in the field of Special Education in the Bureau in Washington, D.C.; the agency controls practices in the field directly through its own programs, and indirectly through its philosophy. Appendix C, page 17 contains responses from some major foundations to a request for monies to purchase equipment to help monitor the effectiveness of Project AEROBIC. The prevalent attitude in these agencies appears to reflect the historical practices of the Bureau. It might seem reasonable that the State of Idaho be expected to absorb the cost of the equipment as a part of its responsibility in the decentralization process. When project AEROBIC was submitted to the bureau in 1979, the devastating effect of the recession on the states economy (forest products, mining and farming) could not be projected. Idaho does have a unique position, in as much as, 75% of the total state budget goes to public education; it is a vast, rural, sparsely populated state facing further cuts in education funding since budget shortfalls impact much more massively in Idaho than might be expected in states where public education takes a smaller "piece of the pie".

"Numerous cirteria have been proposed to ascribe professional status to groups: ....including the degree of empiricism of the body of research and practice which serves as the foundation for the profession" (Sontag 1982). Project AEROBIC is field initiated research, the function of which is to enhance programming in adapted physical education for multiply-handicapped children, especially those with severely/profoundly handicapping conditions. As an exercise physiologist with a special interest in services for handicapped children, I am certain that a need exists for the preparation of special educators who can conceive and conduct experimental and quasi-experimental research (Campbell and Stanley 1963), and then organize, analyze and disemenate the findings. There is evident confusion and contradiction concerning programming and methodology, largely as a result of the lack of a systematic approach to the problems encountered by special educators. We are a profession of practitioners or "technicians" as Dr. Sontag called us in his address. The equipment that is being requested in this proposal is one step towards establishing an empirical base, at least for adapted physical education for the severely/profoundly handicapped. Project AEROBIC is not designed as a personnel preparation model. It is designed as a systematic approach to the identification of activities that will provide physiological (and incidently, psychological) and social benefits to multiply-handicapped children. A critical component in the whole project is the routine evaluation of progress by monitoring various cardiopulmonary and cardiorespiratory parameters (VO_2, RQ, and in selected cases cardiac output using an end title volume CO_2 dilution curve). It was anticipated at the onset of project AEROBIC that funds would become available from non-governmental agencies to purchase the major piece of equipment requested in this proposal. The nature of chemical gas analysis and the time necessary to perform individual gas analyses has resulted in a slower rate of progress toward the goals of project AEROBIC and necessary concomitant changes in the frequency with which the progress of individaul children can be monitored as they participate in the program. The key to program effectiveness lies in the ability of the experimental design to differentiate among potential activities and identify those activities best suited for any given child, and that child's combination of handicaps.

The University of Idaho has a demonstrated commitment to the preparation of superior special educators through its programs in special education (Gentry, Parks et al); in Adapted Physical Education (Laing, Marten, Mulholland, and DePaepe); and in the development of model curricula for multiply-handicapped children (Project AEROBIC). The Division of Health, Physical Education and Recreation at the University of Idaho reaffirms its commitment to the preparation of Special Physical Educators for the future and is in the process of refining a pre-service program for teachers of adapted physical education where a key dimension of the preparation will be participation in ongoing research in special physical education. This participation will be in the form of practica in Project AEROBIC and other demonstration projects as they are developed, as well as a rigorous preparation in basic research design and data analysis. Such a combination will ensure a regular, systematic analysis of problems and issues relevant to special

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physical educators. Equipment reqeusted in this proposal will be used to conduct evaluations of the progress of individual children participating in Project AEROBIC, and thereby ensuring achievement of the primary goals of that project i.e., the production of model curricula for severely/profoundly, multiply-handicapped children. Upon completion of the project, the equipment will be used in the pre-service program preparing Adapted Physical Educators.

This request for equipment is congruent with the spirit of the communication from George A. Conn, Acting Assistant Secretary OSERS (December 10, 1982) where he notified field personnel that:

> "at this particular time the Office Of Special Education and Rehabilitative Services is required to focus its planning resources on developing mandatory plans for research to aid handicapped individuals."

The equipment requested is needed to expand the evaluative processes presented on page by testing all of the handicapped children involved in the programming of Project AEROBIC. It is a significant step toward realization of an empirical base for program development in the preparation of Special Physical Educators.

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APPENDIX C

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RICHARD KING MELLON FOUNDATION
525 WILLIAM PENN PLACE
PITTSBURGH, PENNSYLVANIA 15219

October 6, 1981

Dr. Alexander W. McNeill
Associate Professor
Office of University Research
University of Idaho
Moscow, Idaho 83843

Dear Dr. McNeill:

We have your recent letter requesting a grant from the Richard King Mellon Foundation.

I regret to inform you that we will be unable to honor your request. The Foundation's current priorities are geographically in Pittsburgh and Western Pennsylvania and nationally in a program of land conservation.

We do hope you are successful in obtaining the funds through other sources.

Sincerely yours,

Robert B. Burr

Robert B. Burr, Jr.
Secretary

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Telephones: Area Code 213
274-5126 or 272-7554

Louis B. Mayer Foundation

9441 Wilshire Boulevard - Suite 616
Beverly Hills, California 90212

October 8, 1981

Alexander W. McNeill, Ph.D
Associate Professor
University of Idaho
Office of University Research
Moscow, Idaho 83843

Dear Doctor McNeill:

I am taking the liberty of responding to your letter of October 2nd, addressed to Mr. Myron Fox. Mr. Fox passed away last year and I have replaced him as administrator of the Foundation.

I read your letter with great interest and must congratulate you for exploring an unusual and probably worthy area of research. I regret having to turn down your request for funds, however, but our own resources are severly limited at this time. I am afraid special priorities must be given to local institutions.

Wishing you success in locating the necessary funds to continue your work elsewhere, I remain,

Sincerely,

Daniel Mayer Selznick
President

DMS/fl

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Future H. McDonald
Vice President and Trustee
J. M. McDONALD FOUNDATION, INC.

Suite 112 East
SCOTTSDALE, ARIZONA 85251
Telephone (602) 949-0974
7340 East Shoeman Lane

October 12, 1981

Mr. Alexander W. McNeill, Ph. D
Associate Professor
Univesity of Idaho
Office of University Research
Moscow, Idaho 83843

Dear Mr. McNeill:

We have received your letter of October 2, 1981 inquiring about reciving funds from the J.M. McDonald Foundation, Inc. towards your research project.

The Foundation issues grans each year after the considerations are dealt with at our annual Board of Trustees meeting, held in the Fall.

Since your proposal was receivid after our deadline, it will be given to our Board of Trustees for their consideration for next year's grants. If the Board decides that they can assist you with this project, we, then, will contact you.

Sincerely,

Lori Corcoran

Lori Corcoran
Office Secretary

J.M. McDonald Foundation, Inc.

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THE ANDREW W. MELLON FOUNDATION
140 EAST 62ND STREET
NEW YORK, N. Y. 10021
(212) 838-8400

October 16, 1981

Mr. Alexander W. McNeill
Associate Professor
Office of University Research
University of Idaho
Moscow, Idaho 83843

Dear Mr. McNeill:

This will acknowledge your letter of October 2, in which you request financial support to assist a research project entitled "Project Aerobic: Aerobic Exercise and Research Opportunities to Benefit Impaired Children."

I am sorry to have to tell you that the Foundation has no program currently in operation which would enable us to provide the funds you seek.

I regret the necessity for this discouraging reply and hope that you will find assistance from other sources.

Sincerely yours,

J Kellum Smith Jr.

J. Kellum Smith, Jr.
Vice President and
Secretary

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McDonald's

McDonald's Corporation
McDonald's Plaza
Oak Brook, Illinois 60521

(312) 887-6594
Direct Dial Number

June 15, 1982

Dr. Alexander W. McNeill
Associate Professor
University of Idaho
Physical Education Building
Moscow, Idaho 83843

Dear Dr. McNeill:

Thank you for your kind letter of May 12, 1982, and for giving us the opportunity to review your work.

We currently support more than 200 organizations that work on a wide variety of social, economic, and environmental problems. We have carefully reviewed your request and regret that we are unable to be of assistance at this time. Please do not construe our inability to help as a negative comment on the value of your work. Rather, it is a reflection of the age-old problem of limited resources and considerable need.

Thank you once again for sharing your work with us. Although we cannot be of assistance, we extend our best wishes for your success.

Sincerely yours,

Jeannette Kelley

Jeannette Kelley
Administrative Coordinator
Corporate Contributions &
Community Development

jmj

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William T. Grant Foundation
919 Third Avenue
New York, NY 10022
(212) 752-0071

December 30, 1981

Alexander W. McNeill, Ph.D.
Associate Professor
Div. of Health, Physical Education,
Recreation and Dance
University of Idaho
Moscow, Idaho 83843

Re: Equipment for "Project Aerobic"

Dear Dr. McNeill:

I very much appreciate hearing about your project and proposed plans for the future.

I am sorry that we are unable to assist you with your funding. Each foundation must decide where it will focus its efforts and we have determined to put ours largely into research on school age children, especially those dealing with stress, coping and invulnerability.

I sincerely hope that other foundations or organizations will see fit to support this important project.

Very sincerely,

Robert J. Haggerty

Robert J. Haggerty, M.D.
President

RJH:po

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665 THOMAS ROAD
P.O. BOX 178
(215) 836-7500

F. EUGENE DIXON, JR.
ERDENHEIM FARM
LAFAYETTE HILL, PA. 19444

June 21, 1982

Alexander W. McNeill, Ph.D.
Associate Professor
University of Idaho
Division of Health, Physical
  Education, Recreation and Dance
Physical Education Building
Moscow, Idaho 83843

Dear Dr. McNeill:

In response to your recent letter inquiring about the possibility of securing funding from the Widener Memorial Foundation In Aid of Handicapped Children, please be advised that this Foundation confines its grants to those organizations located in the Greater Delaware Valley Area that serve orthopedically handicapped children only.

I am sorry that your organization does not fall within our funding priorities and do hope that you will be able to secure aid from other sources.

Sincerely yours,

F. Eugene Dixon

F. Eugene Dixon, Jr.
President
WIDENER MEMORIAL FOUNDATION IN
AID OF HANDICAPPED CHILDREN

FED:ejc

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THE GLENMEDE TRUST COMPANY
229 South 18th Street, Philadelphia, Pa. 19103
(215) 875-3200
TELEX: 902175
CABLE: GLENTRUST, PHA

June 22, 1982

Alexander W. McNeill, Ph.D.
Associate Professor
University of Idaho
Division of Health, Physical
  Education, Recreation & Dance
Physical Education Bldg.
Moscow, ID 83843

Dear Dr. McNeill:

Your recent request for funds dated June 16, 1982, has been considered in light of the present policies and objectives of the Pew charitable trusts.

In the field of education primary consideration for funding is given by the Trustees to independent, four-year colleges that are not predominantly tax-supported. Since your institution seems to fall outside those perimeters, I regret we are unable to be of assistance to your educational institution.

We do offer our best wishes, however, for the success of your efforts.

Sincerely,

Louis J. Beccaria, Ph.D.
Trust Officer and Program Manager

LJB/dd

ANDERSEN FOUNDATION
BAYPORT, MINNESOTA 55003

June 22, 1982

Dr. Alexander W. McNeill
Associate Professor
University of Idaho
Physical Education Building
Moscow, ID 83843

Dear Dr. McNeill:

In response to your June 16 letter addressed to Mrs. Katherine B. Andersen, your research program entitled "Project Aerobic" does not come within the scope of our giving and, therefore, will not be considered for funding. Our grants are largely directed to the support of certain private accredited colleges who do not use federal or state tax funds.

Sincerely,

ANDERSEN FOUNDATION

Vice President & Secretary

ECSwanson:ec

SURDNA FOUNDATION, INC.
200 PARK AVENUE
NEW YORK, N.Y. 10166

June 24, 1982

Alexander W. McNeill, Ph.D.
Associate Professor
University of Idaho
Physical Education Bldg.
Moscow, Idaho 83843

Dear Dr. McNeill:

We acknowledge your communication of June 16, regarding the possibility of obtaining a grant from the Surdna Foundation.

As you can understand the Foundation receives a great volume of such requests and has many commitments to other worthy projects. Also, we limit our giving, in general, to organizations in the Northeastern area of the United States, and regret that we will not be able to consider your request.

Sincerely,

SURDNA FOUNDATION, INC.

Assistant to the Administrator

LILLY ENDOWMENT, INC.
2801 NORTH MERIDIAN STREET
POST OFFICE BOX 88068
INDIANAPOLIS, INDIANA 46208-0068
317-924-5471

June 29, 1982

Dr. Alexander W. McNeill
Associate Professor
Division of Health, Physical Education,
Recreation and Dance
University of Idaho
Moscow, Idaho 83843

Dear Dr. McNeill:

Thank you for your letter of June 16, 1982, in which you inquired about the possibilities of funding your research program entitled, "Project Aerobic: Aerobic Exercise and Research Opportunities to Benefit Impaired Children." Richard O. Ristine, Executive Vice President, has referred it to me for reply.

To my regret, I must inform you that the Lilly Endowment will not be able to be of assistance in providing funds for your program. This decision is not based upon a negative evaluation of the program itself but reflects the fact that your project falls outside the program priorities established for the Education Division. In attempting to focus our funds, we find it necessary to decline assistance to many worthwhile projects such as the one you submitted.

We appreciate your interest in addressing the Lilly Endowment and trust that you will be able to find sufficient funding from other sources.

Sincerely,

H Dean Evans
H. Dean Evans
Senior Program Officer and
Director of Elementary-Secondary
Education Programs

HDE:dw

The Joseph P. Kennedy, Jr. Foundation

1701 K STREET, NORTHWEST, SUITE 205
WASHINGTON, D. C. 20006
(202) 331-1731

July 6, 1982

Alexander W. McNeill, Ph.D.
Associate Professor, Division of Health,
Physical Education, Recreation and
Dance
University of Idaho
Physical Education Building
Moscow, ID 83843

Dear Dr. McNeill:

The Joseph P. Kennedy, Jr. Foundation has received your recent letter regarding financial assistance. We are pleased to learn about your program.

Your request for support has been reviewed. Although we believe it is a very worthwhile project, it is not possible at this time for the Foundation to provide financial assistance. Foundation funds are presently committed to the Special Olympics program, major centers in medical ethics established by the Foundation at Georgetown and Harvard Universities, Kennedy Fellowships in Medical Ethics for Nursing Faculty, development of a "Family Life & Sex Education" curriculum and our Let's Play to Grow program. Our advisors feel that by supporting these focused areas we can be most effective in benefiting the mentally retarded and other individuals needing special assistance. Unfortunately, because of these commitments, available funds for other projects are extremely limited.

We have enclosed some information on the Foundation and its programs which may be of interest to you. Also enclosed is a list of agencies which may be able to provide you with information as to alternative sources of funding.

Please understand that our decision does not reflect on the importance or quality of your request. We wish you every success in obtaining the funds necessary for your work.

Sincerely,

Eunice K. Shriver

Eunice Kennedy Shriver

EKS/ed

Enclosures

Appendix B

3rd Year Continuing Report

C 3 Approval No. 29-R0211

FEDERAL ASSISTANCE

1. TYPE OF ACTION (Mark appropriate box)
☐ PREAPPLICATION
☒ APPLICATION
☐ NOTIFICATION OF INTENT (Opt.)
☐ REPORT OF FEDERAL ACTION

2. APPLICANT'S APPLICATION
a. NUMBER
b. DATE Year month day 19 83 3 29

3. STATE APPLICATION IDENTIFIER
a. NUMBER
b. DATE ASSIGNED Year month day 19

Leave Blank

SECTION I—APPLICANT/RECIPIENT DATA

4. LEGAL APPLICANT/RECIPIENT
a. Applicant Name : University of Idaho
b. Organization Unit : Division H.P.E.R.
c. Street/P.O. Box :
d. City : Moscow
e. County : Latah
f. State : Idaho
g. ZIP Code: 83843
h. Contact Person (Name & telephone No.) : Dr. Alex McNeill 208 - 885 - 7921

5. FEDERAL EMPLOYER IDENTIFICATION NO.

6. PROGRAM (From Federal Catalog)
a. NUMBER 8 4 • 0 2 3
b. TITLE Handicapped - Fie
Initiated Research

7. TITLE AND DESCRIPTION OF APPLICANT'S PROJECT
AEROBIC Exercise and Research Opportunities to Benefit Impaired Children

8. TYPE OF APPLICANT/RECIPIENT
A—State
B—Interstate
C—Substate District
D—County
E—City
F—School District
G—Special Purpose District
H—Community Action Agency
I—Higher Educational Institution
J—Indian Tribe
K—Other (Specify):
Enter appropriate letter ☐

9. TYPE OF ASSISTANCE
A—Basic Grant
B—Supplemental Grant
C—Loan
D—Insurance
E—Other
Enter appropriate letter(s) A

10. AREA OF PROJECT IMPACT (Names of cities, counties, States, etc.)
Idaho and N. Utah

11. ESTIMATED NUMBER OF PERSONS BENEFITING

12. TYPE OF APPLICATION
A—New
B—Renewal
C—Revision
D—Continuation
E—Augmentation
Enter appropriate letter ☐

13. PROPOSED FUNDING

a. FEDERAL	$ 96,326	.00
b. APPLICANT	6,214	.00
c. STATE		.00
d. LOCAL		.00
e. OTHER		.00
f. TOTAL	$ 102,540	.00

14. CONGRESSIONAL DISTRICTS OF:
a. APPLICANT Latah
b. PROJECT Latah

15. TYPE OF CHANGE (For 12c or 12e)
A—Increase Dollars
B—Decrease Dollars
C—Increase Duration
D—Decrease Duration
E—Cancellation
F—Other (Specify):
Enter appropriate letter(s) ☐☐

16. PROJECT START DATE Year month day 19 83 10 1

17. PROJECT DURATION 36 Months

18. ESTIMATED DATE TO BE SUBMITTED TO FEDERAL AGENCY ▶ Year month day 19 83 03 31

19. EXISTING FEDERAL IDENTIFICATION NUMBER
G008102717

20. FEDERAL AGENCY TO RECEIVE REQUEST (Name, City, State, ZIP code)
U.S. Department of Education, Application Control Center, Washington, D.C. 20202

21. REMARKS ADDED ☐ Yes ☐ No

SECTION II—CERTIFICATION

22. THE APPLICANT CERTIFIES THAT ▶
a. To the best of my knowledge and belief, data in this preapplication/application are true and correct, the document has been duly authorized by the governing body of the applicant and the applicant will comply with the attached assurances if the assistance is approved.
b. If required by OMB Circular A-95 this application was submitted, pursuant to instructions therein, to appropriate clearinghouses and all responses are attached:

	No response	Response attached
(1)	☐	☐
(2)	☐	☐
(3)	☐	☐

23. CERTIFYING REPRESENTATIVE
a. TYPED NAME AND TITLE Gerald Reynolds, Controller
b. SIGNATURE
c. DATE SIGNED Year month day 19

SECTION III—FEDERAL AGENCY ACTION

24. AGENCY NAME

25. APPLICATION RECEIVED Year month day 19

26. ORGANIZATIONAL UNIT

27. ADMINISTRATIVE OFFICE

28. FEDERAL APPLICATION IDENTIFICATION

29. ADDRESS

30. FEDERAL GRANT IDENTIFICATION

31. ACTION TAKEN
☐ a. AWARDED
☐ b. REJECTED
☐ c. RETURNED FOR AMENDMENT
☐ d. DEFERRED
☐ e. WITHDRAWN

32. FUNDING

a. FEDERAL	$	.00
b. APPLICANT		.00
c. STATE		.00
d. LOCAL		.00
e. OTHER		.00
f. TOTAL	$	.00

33. ACTION DATE ▶ Year month day 19

34. STARTING DATE Year month day 19

35. CONTACT FOR ADDITIONAL INFORMATION (Name and telephone number)

36. ENDING DATE Year month day 19

37. REMARKS ADDED ☐ Yes ☐ No

4

38. FEDERAL AGENCY A-95 ACTION
a. In taking above action, any comments received from clearinghouses were considered. If agency response is due under provisions of Part 1, OMB Circular A-95, it has been or is being made.
b. FEDERAL AGENCY A-95 OFFICIAL (Name and telephone no.)

ED Form 9037, 6/80 (CFDA #84.023)

STANDARD FORM 424 PAGE 1 (10-75)

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SECTION IV—REMARKS *(Please reference the proper item number from Sections I, II or III, if applicable)*

NOTE: If person responsible for grant negotiations is different from person named in Item 4h. please identify by name and phone number in this space.

name: ______________________________

phone: ______________________________
(area code) (number) (extension)

OMB NO. 29-R0218

PART II
PROJECT APPROVAL INFORMATION

ITEM 1.
Does this assistance request require State, local, regional, or other priority rating?
☐ Yes ☐ No
Name of Governing Body ____________
Primary Duties ____________

ITEM 2.
Does this assistance request require State, or local advisory, educational or health clearances?
☐ Yes ☐ No
Name of Agency or Board ____________
(Attach Documentation)

ITEM 3.
Does this assistance request require clearinghouse review in accordance with OMB Circular A-95?
☐ Yes ☐ No
(Attach Comments)

ITEM 4
Does this assistance request require State, local, regional, or other planning approval?
☐ Yes ☐ No
Name of Approving Agency ____________
Date ____________

ITEM 5
Is the proposed project covered by an approved comprehensive plan?
☐ Yes ☐ No
Check one:
☐ State
☐ Local
☐ Regional
Location of Plan ____________

ITEM 6
Will the assistance requested serve a Federal Installation?
☐ Yes ☐ No
Name of Federal Installation ____________
Federal Population benefiting from Project ____________

ITEM 7
Will the assistance requested be on Federal land or Installation?
☐ Yes ☐ No
Name of Federal Installation ____________
Location of Federal Land ____________
Percent of Project ____________

ITEM 8
Will the assistance requested have an impact or effect on the environment?
☐ Yes ☐ No
See instructions for additional information to be provided.

ITEM 9
Will the assistance requested cause the displacement of individuals, families, businesses, or farms?
☐ Yes ☐ No
Number of:
Individuals ____________
Families ____________
Businesses ____________
Farms ____________

ITEM 10
Is there other related assistance on this project previous, pending, or anticipated?
☒ Yes ☐ No
See instructions for additional information to be provided.
Supplemental request submitted Jan 1983
REF 029KH30216

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OMB APPROVAL NO. 29-R0218

PART III – BUDGET INFORMATION

SECTION A – BUDGET SUMMARY

GRANT PROGRAM, FUNCTION OR ACTIVITY (a)	FEDERAL CATALOG NO. (b)	ESTIMATED UNOBLIGATED FUNDS		NEW OR REVISED BUDGET		
		FEDERAL (c)	NON-FEDERAL (d)	FEDERAL (e)	NON-FEDERAL (f)	TOTAL (g)
1.		$	$	$ 96,326	$	$
2.						
3.						
4.						
5. TOTALS		$	$	$ 96,326	$	$

SECTION B – BUDGET CATEGORIES

6. OBJECT CLASS CATEGORIES	GRANT PROGRAM, FUNCTION OR ACTIVITY				TOTAL
	(1)	(2)	(3)	(4)	(5)
a. PERSONNEL	$ 53.445	$	$	$	$
b. FRINGE BENEFITS	9,456				
c. TRAVEL	5,500				
d. EQUIPMENT					
e. SUPPLIES	2,200				
f. CONTRACTUAL					
g. CONSTRUCTION					
h. OTHER	1,500				
i. TOTAL DIRECT CHARGES	72,101				
j. INDIRECT CHARGES	24,225				
k. TOTALS	$ 96,326	$	$	$	$
7. PROGRAM INCOME	$	$	$	$	$

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OMB APPROVAL NO. 29-R0218

SECTION C – NON-FEDERAL RESOURCES

(a) GRANT PROGRAM	(b) APPLICANT	(c) STATE	(d) OTHER SOURCES	(e) TOTALS
8.	$	$	$	$
9.				
10.				
11.				
12. TOTALS	$	$	$	$

SECTION D – FORECASTED CASH NEEDS

	TOTAL FOR 1ST YEAR	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
13. FEDERAL	$	$	$	$	$
14. NON-FEDERAL					
15. TOTALS	$	$	$	$	$

SECTION E – BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) GRANT PROGRAM	FUTURE FUNDING PERIODS (years)			
	(b) FIRST	(c) SECOND	(d) THIRD	(e) FOURTH
16.	$	$	$	$
17.				
18.				
19.				
20. TOTALS	$	$	$	$

SECTION F – OTHER BUDGET INFORMATION (attach additional sheets if necessary)

21. DIRECT CHARGES: See budget explanation

22. INDIRECT CHARGES: Based upon a rate of 33.6% direct charges

23. REMARKS:

PART IV – PROGRAM NARRATIVE (attach per instructions)

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U.S. Department of Education
Office for Special Education and Rehabilitative Services

EDUCATION FOR THE HANDICAPPED

SUPPLEMENTARY QUESTIONNAIRE

1. APPLICANT NAME (from Item 4 on SF 424)	2. DESCRIPTIVE TITLE OF PROJECT (from Item 7 on SF 424)

INSTRUCTIONS

Programs may involve Demonstration/Service activities and/or Preservice or Inservice Training activities. Any applicant whose project calls for such activities must fill out the relevant portions of the tables below. Data presented should be for the year of funding requested and will be used as one base measure to determine accomplishment for Demonstration/Service and/or Preservice or Inservice Training activities.

In Table 1 enter the projected performance data for the first budget period into the appropriate boxes. Use age as of the start of the grant project. Data for lines 1 through 11 are for those enrolled or receiving major services and not merely screened, referred, or given minimal or occasional services.

Table 2: Preservice/Inservice Training Activities. Persons can receive training in two or more areas of concentration. While it is acceptable to have duplicate counts of trainees across areas of concentration (rows 1-12), the TOTAL (row 13) should represent an *unduplicated count* of persons to receive training.

TABLE 1
PART A – DEMONSTRATION SERVICE ACTIVITIES

TYPE OF HANDICAP	NUMBER OF HANDICAPPED PERSONS TO BE SERVED BY AGE			
	AGES 0-2	AGES 3-5	AGES 6-8	AGES 9-21
1. MENTALLY RETARDED			10	80
2. HARD OF HEARING				20
3. DEAF				30
4. SPEECH IMPAIRED				
5. VISUALLY HANDICAPPED				20
6. SERIOUSLY EMOTIONALLY DISTURBED				
7. ORTHOPEDICALLY IMPAIRED				20
8. OTHER HEALTH IMPAIRED				15
9. SPECIFIC LEARNING DISABILITIES				
10. DEAF-BLIND				5
11. MULTIHANDICAPPED				100
12. TOTAL				130

TABLE I
PART B – PROJECT STAFF TO PROVIDE SERVICES TO RECIPIENTS IN TABLE IA

TYPE OF STAFF	NUMBER OF STAFF	
	FULL-TIME	PART-TIME* (As full-time equivalents)
PROFESSIONAL PERSONNEL (excluding teachers)	0.25	
TEACHERS**	2.0	
PARAPROFESSIONAL		

TABLE I
Part C – ANCILLARY SERVICES TO PERSONS WITH SPECIAL NEEDS
(Including Recipients in Table IA)

SERVICE	NUMBER OF PERSONS
SCREENED	
DIAGNOSTIC AND EVALUATIVE	130
OTHER RESOURCE ASSISTANCE (specify)	

*Amount of time for less than full-time work divided by time normally required in a corresponding full-time activity.

**Professional staff members who instruct pupils.

TABLE 2. PRESERVICE/INSERVICE TRAINING ACTIVITIES

AREA OF CONCENTRATION	NUMBER OF STUDENTS TO RECEIVE PRE-SERVICE TRAINING BY DEGREE LEVEL				NUMBER OF PERSONS TO RECEIVE INSERVICE TRAINING	
	Assoc. Level	Bachelors Level	Masters Level	Post-Masters Level	Regular Educators	Special Educators*
1. ADMINISTRATION						
2. EARLY CHILDHOOD						
3. MENTALLY RETARDED					1	30
4. DEAF/HARD-OF-HEARING						18
5. SPEECH IMPAIRED						
6. VISUALLY HANDICAPPED						5
7. SERIOUSLY EMOTIONALLY DISTURBED						
8. ORTHOPEDICALLY IMPAIRED					1	20
9. OTHER HEALTH IMPAIRED						20
10. SPECIFIC LEARNING DISABILITIES						
11. DEAF-BLIND						5
12. MULTIHANDICAPPED					1	51
13. TOTAL (Unduplicated Count)					1	51

*Special educators are defined as those teachers licensed, certified, or registered to provide special education services to meet the needs of handicapped children.

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BUDGET EXPLANATIONS

Personnel	Year 1	Year 2	Year 3
No additional funds are requested for personnel, howver, it is proposed that the monies identified for consulting in the previous continuation request be added to the salary of one of the Project Manager positions to accomodate the needs of Mr. Mulholland. Rationale is included in the text of the document			
Project Director Summer employment; during the academic year, 0.25 of his salary will be an in kind contribution.			$6293
Laboratory Assistant			$9910
Richard Mulholland Project Manager (Full time) 12 mth appointment			$19119
Project Manager (Full time) 12 mth appointment			$15400
Clerical help			$2723
Fringe Benefits			
Project Director			$1322
Laboratory Assistant			$694
Richard Mulholland			$4015
Project manager (Fringe benefits for the above: Group Life Insurance, Workmens Compensation, Retirement, Employment Security, Social Security (FICA), Disability Income)			$3234
Irregular help (Fringe benefits: Social Security, Workmens Compensation, Employment Security.			$191

Travel

Travel to Nampa and Gooding, both accessed through Boise.

Air fare round trip Moscow - Boise	$195
Lodging (three nights)	$140
Car rental (three days/trip)	$185
Per diem $15/day for three days	$ 45
	$565

	Year 3
Eight trips for data collection and supervision	$4520
SEP, DPP, TADS Meeting December 1983 Washington D.C.	$980

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Budget explanations cont.	Year 1	Year 2	Year 3
Supplies			
Metals, electronic supplies, tools, electrodes, etc for adapting equipment for use with the handicapped			$2200
Other			
Printing materials (testing materials)			$400
Communications (long distance telephone, U.S. mail)			$1100
Totals			
Direct costs			$72101
Indirect Costs			$24225
			$96326

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PROGRAM NARRATIVE

Project Objectives

The following objectives describe the research, demonstration, and training component activities for the project involving Aerobic Exercise and Research Opportunities to Benefit Impaired Children (Project AEROBIC).

1.0 Research the possible assessment, objectives, and training procedures which can be used with severely and profoundly handicapped children ages 10-21 years.

  1.1 Modify equipment and procedures for measuring cardiorespiratory fitness to be appropriate for use with severely and profoundly handicapped children.
  1.2 Develop a curriculum for a hierarchy of skill objectives for developing increasing levels of cardiorespiratory fitness in severely and profoundly handicapped children.
  1.3 Determine the instructional strategies which effectively provide for increases in the cardiorespiratory fitness of severely and profoundly handicapped children.
  1.4 Evaluate the effectiveness of the instrumentation, curriculum and instructional strategies for measurement and training in cardiorespiratory fitness and its effect upon self-help, social, and academic functioning.

2.0 Provide a physical education exercise program for severely and profoundly handicapped children, which utilizes the curriculum and strategies being developed for cardiorespiratory fitness, as a model demonstration program for state institutions and public schools.

  2.1 Provide training for awareness of the environment.
  2.2 Provide training for object control.
  2.3 Provide training for locomotor movement and skills.

3.0 Provide inservice training for teachers and support personnel directly involved in the research and exercise program for Project AEROBIC.

  3.1 Train teachers to use the equipment and procedures necessary for data collection in component 1.0.
  3.2 Train teachers to utilize the curriculum and instructional strategies in order to provide the physical education exercise program.
  3.3 Monitor data collection and training within the exercise program to assure proper use of methodology.

4.0 Administratively, it will be an objective of Project AEROBIC to disseminate findings from the research and exercise program. This will be accomplished by presentations at conferences and submission of articles for publication. The curricular materials developed by Project AEROBIC will be submitted to the Marketing Task Force of the Bureau of Education for the Handicapped to determine suitability of the materials for commercial distribution, as arranged by the Market Linkage Project for Special Education, LINC Services, Inc.

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A timetable for accomplishing these objectives is outlined below:

Year One

A. Modify exercise testing equipment and protocols suitable for use in the evaluation of the cardiorespiratory function of severely handicapped children, in particular the multi-handicapped. Obtain measures of reliability and validity.

B. Obtain baseline data of movement abilities and physiological functioning for subject population and compare to other studies and curricular hierarchies. Develop a lattice of movement skills leading from low level basic movement, such as tracking, reaching, and grasping, to high level aerobic activities, such as bicycling (with hand or foot pedals), swimming, and running. Collect data on effects of instructional strategies.

C. Train support personnel in the use of simple testing equipment, testing protocols, and teaching procedures for using the curricular materials.

Year Two

A. Continue to modify equipment and protocols as needed. Test subjects on cardiorespiratory functioning.

B. Begin formal exercise program with ongoing data collection. Continue personnel training as needed and monitor progress.

C. Refine and expand the lattices as needed, based on results midway through the second year.

Year Three

A. Increase the population in Idaho for testing and training with the revised curricular materials.

B. Develop more options and adaptions of instructional strategies and exercise programs, based upon the results from Year Two. Continue data collection.

C. Establish liaison with institutions and schools in nearby states for replication of program results. Begin training of personnel.

D. Submit the exercise program to the National Diffusion Network for national distribution and validation.

E. Submit the curricular materials for publication.

Accomplishments

During the first six months of this second year of the project, I feel that we have experienced excellent progress at one site (The Idaho State School and Hospital, Nampa) and very limited success at the Idaho State School for the Deaf and Blind in Gooding.

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The individual that was hired as a project director at the State School for the Deaf and Blind had excellent credentials and outstanding recommendations. The selection committee at the University of Idaho, and the interviewing committee in Gooding were unanimous in their selection of this candidate for the position. It appeared that the project was off to a good start. The initial two months of the project manager's appointments were to be spent observing the children, working with the teachers and professionals in the institutions and generally gearing up to initiate programming at the beginning of December 1982; programming was to be firmly in place by Mid January 1983. The first indication of difficulties at the Gooding site surfaced December 21, 1982 during a routine administrative visit. At that time the unit supervisor and the Vice Principal expressed some concern in relation to the project directors practical skills. Mr. Mulholland and myself immediately began an intensive series of in-service kinds of experiences to attempt to elevate the project director's skills to a level that would meet our own high standards, and adequately fulfill our commitment to the institution. The in-service experiences were completed by late January 1983; at that time the project director was informed that her performance would be monitored and an assessment made before March 1, 1983 and a decision made concerning her retention. The Gooding project director resigned effective March 18, 1983.

The reputation of the project and its general acceptance at the Idaho State School for the Deaf and Blind was seriously threatened by this unfortunate series of events. In order to ensure success of the project, and a rapid establishment of viable programming at the school, I convinced Mr. Mulholland (he was originally co-investigator) to assume the position at Gooding; he agreed to do this if the consulting funds and the remaining portion of the project director's salary were combined to give a salary equivalent to $17,000 annually. Mr. Mulholland has been in the position since March 21, 1983 and I feel confident that he will be able to get the project back on track and allow us to meet our objectives for year two of the project.

The project site at Nampa is evolving as anticipated with a steady growth of programming to meet the needs of the residents. (see Appendix A)

1. We have in place now two competent professionals developing activities for severely/profoundly handicapped children.

2. a. The program at Nampa, at the State School and Hospital, has gone through its first major evolutionary step. Much of the programming for the severely/profoundly handicapped children, outside of project AEROBIC is developmentally based; much of it dealing with motor coordination. The initial programming was tailored to compliment the vestibular stimulation model that was being used in the general classroom. Activities were developed that involved vestibular stimulation, e.g. various types of trampoline activities (passive for the more impaired client and active for those capable of movement), swinging activities using a variety of swings capable of motion that would stimulate the vestibular apparatus in the sagittal; frontal, and transverse planes; scooter board activities, again passive and active. When a child is non ambulatory, it is not exposed to a changing environment; moving these children within, and through their environment has resulted in much positive improvement. (see Appendix A) The second step of the programming moves the client into activities that are designed to encompass self help tasks, ambulation and other locomotory skills. Those residents who can still benefit from the vestibular stimulation activities will continue to be exposed to them.

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b. During the first half of this project year, we have built a variety of vestibular stimulation swings. All have nylon netting and safety straps to secure the clients as they participate in the program. Some of the swings were manufactured using elastic shock cords to allow for vertical displacement in addition to movements normally associated with swinging.

c. In the inital vestibular stimulation phase of the study we built scooter boards to meet the needs of the individual clients. Besides the obvious differences in size needed for very young children and larger older children, each child needed support offered in different places. We found that large blocks of foam, shaped in wedges, could be taped to the basic scooter board and support customized for any child. Extensive use was made of nylon webbing and "velcro" fasteners to help hold the child on the board.

3. Routine monitoring of blood pressure and heart rates has been established on a weekly basis; more frequent evaluation of heart rate responses is common for activities that might generate an increase in cardiovascular activity.

4. We are presently seeking to modify the existing protocol for underwater weighing to determine body density. We are attempting to develop a regression equation that will allow us to predict the volume of the head from simple anthropometric measurements. Subsequently, we will weigh the subjects submerged to their chins, and mathematically estimate the contribution of the head; lung volumes will also be estimated and additional corrections made. We think that the development of a technique especially for severely/profoundly handicapped individuals is preferable to using the sub-cutaneous fat-caliper method commonly used for non-handicapped individuals. The caliper technique is not especially accurate, even when used with a population that is non-handicapped.

5. We continue to wrestle with the problem of measuring the oxygen consumption of these severely/profoundly handicapped children. It was anticipated that we would have been successful in obtaining support from non-profit organizations to purchase the much needed electronic equipment for this particular phase of the study. A description of the pursuit of these funds and a copy of a proposal submitted to S.E.P. for supplemental funding is included as Appendix B of this document (U.S. Department of Education reference no. 029KH30216.) The nature of chemical gas analysis (we are presently working with a Micro-Scholander System) and the time necessary to perform individual gas analyses has resulted in a slower rate of progress toward some of the goals of project AEROBIC and necessary concomitant changes in the frequency with which the progress of individual children can be monitored as they participate in the program. The key to program effectiveness lies in the ability of the experimental design to differentiate among potential activities, and identify those activities best suited to any given child and that child's combination of handicaps. At the present time we are limited, by the nature of our instrumentation, to making observations from those clients that would be considered as higher functioning within the severely/profoundly handicapped population.

6. The children involved in the project have all undergone the screening referred to in the 1982 continuation request. The screening is outlined below:

A. Type of disorder and level of involvement.
Type I Child - diagnosed cerebral palsy (spastic or athetosis), paraplegia.
Type II Child - micro-cephaly and concomitant delays in neuromotor development, marked flaccidity.
Type III Child - ataxic disorders requiring great amounts of assistance and support.
Each of the above classifications may be viewed as including a sample of children from the severely/profoundly handicapped population. Activities appropriate for each general classification are identified and matched with the individual child. Although this screening process may match a child with several activities, we can assume that only one may prove successful.

B. As indicated in accomplishment 2, we are now progressing to meet the specific locomotor needs of the children through activities such as those below:

1. Type I Child - severely and profoundly retarded, diagnosed athetosis cerebral palsy paraplegia, responsive to simple verbal commands.
Equipment: one three-wheeled cycle with interchangeable gear sprockets permitting the workload to be modified. The bicycle is adapted so it may be pedaled by hand. An ortho-plastic grip designed in the form of a gauntlet, is attached to the pedals and the child's hands are placed into the apparatus. Heart rate will be monitored using the auditory monitor described earlier.
Procedure - the child is motivated by the therapist to pedal the bicycle at an arbitrary rate, while the therapist monitors changes in heart rate at 15 second intervals. The activity is stopped when the desired work has been performed. If the workload does not produce adequate change in heart rate, changes in the gear sprochet will allow for manipulation of such factors as resistance and pedal speed.

2. Type II Child - severely and profoundly retarded, flaccid masculature, non-responsive to verbal commands.
Equipment: 1 stationary three wheeled cycle adapted for hand pedaling with a variable speed motor drive attached to the pedal mechanism. Ortho-plastic grips designed in the form of gauntlet attached to pedals. One auditory heart rate monitor.
Procedure - The child's hands are placed in the ortho-plastic gauntlet grips. The motor drive turns the pedals, while the therapist monitors the heart rate at 15 second intervals. The therapist can alter the workload by manipulating the variable speed drive to the pedals.

3. Type III Child - severely and profoundly retarded, delayed motor development, ambulation with assistance, responsive to simple verbal commands.
Equipment: Four point walker modified by the attachment of a diaper-like apparatus serving to support and stabilize the child. Wheel casters with 360 degree rotation are attached

to the weight bearing points of the walker. One auditory heart rate counter.
Procedure - Child is placed in the walker apparatus. Therapist stands in front of the child and utilizes the necessary prompts and/or reinforcements to motivate the child to move forward with the walker. During this time the therapist monitors the child's heart rate on the 15 second schedule until the desired heart rate range is achieved. The therapist, using this auditory feedback process, can alter the pace of the activity in order to keep the child's heart rate in the appropriate range.

The rate of progress of individual children anticipated in the previous continuation proposal (1982) was somewhat overly optimistic. We remain confident, however, that the project is progressing toward its goals in a timely manner, given the limitations imposed by our equipment.

Plans

The timetable for accomplishing project objectives is presented on page 2. Equipment modification and protocol development will continue as shown below:

1. We anticipate beginning the measurement of metabolic parameters in June of this year (1983). These data will be baselines for all of our subjects. The baseline phase, with necessary modification of protocols, will continue through September 1983; routine evaluation of programming effectiveness will continue through the third year (1983-1984).

2. The formal, daily physical education programs presently in place at the State School and Hospital, Nampa, and soon to be in place at the State School for the Deaf and Blind in Gooding will continue and be expanded during the third year. Each child will continue to be given an assessment of movement behavior, based upon the skill hierarchy of the curriculum, and an assessment of cardiorespiratory functioning. The assessments will be conducted in accordance with the due process and evaluation procedures required by Public Law 94-142. Students who are potentially "at risk" from the testing will not be assessed; or they will be included in the program with a physician's approval. An individualized education program (IEP) will be developed through a team meeting for each child. Appropriate goals and objectives from the AEROBIC curriculum will be assigned to each child, based upon the results of the assessments.

3. With the protocols and expertimental procedures established this year, we will expand the metabolic measurement phase to other handicapped children in Idaho and disseminate programming by presentations at State and District C.E.C. meetings, as well as through publications in various professional journals.

4. The total programming concept, will be together with programming materials, will be developed for dissemination nationally.

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Appendix C

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Cardiovascular Responses of Three Profoundly Retarded, Multiply-Handicapped Children During Selected Motor Activities

Richard Mulholland, Jr., University of Idaho

and

Alexander W. McNeill, Montana State University

Running head: CARDIOVASCULAR RESPONSES OF HANDICAPPED CHILDREN

Request Reprints to Dr. McNeill,
Department of Health, Physical
Education and Recreation
Montana State University
Bozeman, Montana 59717

Abstract

The purpose of the study was to evaluate the effects of physical activities on the cardiovascular performances of 3 institutionalized, profoundly retarded, multiply-handicapped children. Heart rates were recorded during the completion of selected motor activities using a combination of telemetered electrocardiograms (ECG) and standard wireless microphone/video technology. Each subject participated in the experiment for a minimum of 6 weeks. The relationships between mean heart rates and performance times for each subject were evaluated throughout the experiment.

Based upon the data collected in this study we concluded that gross motor activities can have a significant effect on the cardiorespiratory functioning of profoundly retarded, multiply-handicapped children, provided that the activities are performed for an extended period of time, and on a regular basis. The activities selected for use in this study were developmentally based, and no special consideration was given to their "aerobic" demands on the subjects. The level of functioning of the subjects dictated the use of developmental criteria rather than other more "fitness" oriented criteria that are usually applied to non-handicapped individuals.

Deficits in motor behavior, intellectual functioning and adaptive behavior are characteristics of profoundly retarded, multiply-handicapped children. These children are fragile, and are subjected to an existence of inactivity resulting in atrophy and its associated medical and physical problems, e.g. rigidity, cardiovascular disease, decrease in range of motion. Children with the greatest degree of involvement are generally confined to institutional settings. The profoundly retarded, multiply-handicapped child may also experience extensive neurodevelopmental delays, including absence of normal, protective reflexes, and the inability to acquire fundamental motor patterns. Rudimentary skills such as rooting, sucking and swallowing also may be absent and must be taught to ensure the infant's survival. Higher level motor behaviors, e.g. crawling, rolling, creeping, feeding, and ambulation, are generally acquired at a much later time, if they are mastered at all. Special Educators have recognized the developmental needs of these children, as a result, motor skill acquisition constitutes the major portion of their educational plans (Stainback, Stainback, Wehman & Spangler, 1983; Moon & Renzaglia, 1982; Wehman & Marchant, 1977; Broadhead, 1981). In the past, teachers' selection of motor activities have been based upon deductive reasoning, and evaluation criteria have been associated, primarily, with functional task performance. There has been little attempt to evaluate the stresses placed on the child`s cardiovascular system during participation in motor programs.

The purpose of this study was to evaluate the effects of physical activities on the cardiovascular responses of institionalized, profoundly retarded, multiply-handicapped children at the Idaho State School for the Deaf and the Blind (ISSDB).

The growth in popularity of physical fitness programs for non-handicapped individuals has been accompanied by a concomitant growth in similar programs for handicapped children. However, there is a dearth of experimental literature concerning the effects of physical fitness activities on the systemic functioning of profoundly retarded, multiply-handicapped children. The two experimental studies (Wehman, Renzaglia, Berry, Schutz, & Karan, 1978; Stainback, Stainback, Wehman & Spangler, 1983) reported in the literature do not examine the effects of programs on any fitness related parameters, rather, they evaluate the generalized learning and retention of selected, traditional physical fitness skills.

Method

A single subject design was selected for use in this study. Rationale for using designs of this type has been adequately discussed elsewhere (Allport, 1962; Bergin & Strupp, 1972).

Subjects for the study were three profoundly retarded, multiply-handicapped students enrolled at ISSDB during the academic year 1983-84. Residents at ISSDB are classified according to State of Idaho standards which define profoundly retarded clients as individuals who demonstrate obvious delays in all areas of development and require early sensorimotor training. Such individuals respond to systematic motor, communication, basic self-help, and social responsiveness instruction barring specific disabilities or health problems incompatible with targeted behaviors to be learned. Skilled nursing care and aids/ prostheses for mobility, movement or alignment are often required as a part of necessary maintenance; I.Q. estimates 19 and below. In addition to being profoundly retarded, each subject exhibited a variety of handicapping conditions as detailed below. All subjects performed their motor programs 2 or 3 times/week for 6 weeks under the supervision of the investigators.

Heart rates were monitored using a small biomedical radiotelemetry device that permitted remote observations of a standard electrocardiogram (ECG) from electrodes attached to the right costal margin of the sternum and at the intersection of the fifth intercostal space and the midclavicular line. The demodulated signal was recorded using a Hewlett Packard electrocardiograph and oscilloscope (CRO). Although a complete ECG wave form was recorded, heart rates only were used in this series of observations. Further evaluation of ECGs would require the expertise of a cardiologist. A schematic of the data collection system is presented in figure 1.

Insert Figure 1 about here

Subjects in this study were all students in the Multi-Handicapped Learning Center at I.S.S.D.B.; they have all been residentsat I.S.S.D.B. since shortly after birth. They are either bedridden or confined to a wheelchair; there is no foreseeable change in placement. The children's I.Q. estimates place them approximately five standard deviations below the population mean. Literature available dealing with physiological responses to training deals, for the most part, with non-handicapped populations. The standard protocols of approximately 20 minutes of continuous, rhythmic activity, three times per week is not at all suitable for these multi-handicapped, profoundly retarded children. Similarly, we cannot reasonably apply expectations derived from programs for non-handicapped populations to these children. The exercise experiences used for the children in this study would not result in any observable cardiovascular responses in a non-handicapped population. As the results of this study are evaluated we must bear in mind the years of total physical inactivity experienced by the subjects.

The multi-handicapped program at I.S.S.D.B. combines appropriate educational placements during the course of the school day with long-term, skilled nursing care in a facility where the children reside when school programming is non operative. The residential facility provides a skilled nursing environment where medications can be administered as needed, and the children's various bodily functions may be monitored and controlled on an "as needed" basis.

Subject I

Subject I is a 22 year old male with behaviors and abilities characteristic of classic Rubella Syndrome. His physical stature is slight (92 lb.) with general hypotonia as a result of growth hormone deficiency. Neurological dysfunctions are evidenced by a history of seizure activity, presently controlled with 200 mg/day Dilantin, 90 mg/day Phenobarbital and 400 mg/day Tegratol. Other characteristics indicate an overall developmental delay resulting in non-attainment of many of the normal developmental milestones. He is totally blind, is non-ambulatory, but has hearing within normal limits. Although Subject I is significantly hypotonic, he has acceptable control of head, neck, shoulder girdle and arms arms while in a seated position. He is unable to stand unassisted but able to walk with a four point wheeled walker. When placed in a vertical position, Subject I yields a 20-25 degree bilateral deviation from midline while attempting to correct postural imbalances. The medication produces a state of continuous lethargy, as a result, he usually sleeps while not involved in structured program activity. Initially, all activities were performed either prone or supine.

While resting supine on a trampoline, Subject I was asked if he wanted to bounce. If he responded by saying "bounce", music was played with the tempo gradually increasing. The tempo of the music was used to attain a desired workload as determined by heart rate recorded from the telemetered ECG. The criterion performance was ten trials for 30 seconds each, or any lesser number of trials when the bouncing totalled five minutes; heart rates were recorded throughout the bouncing.

Data collected from Subject I are presented in Figure 2.

Insert Figure 2 about here

These data illustrate the average performance time bouncing, and the mean heart rates achieved during each intervention day. They provide a good example of the relationship between work done and metabolic responses; as the average bouncing time increases, the mean heart rate increases. Although Figure 2 illustrates well the relationship between the energy requirement of physical activity and heart rate, it is the most disappointing in terms of observable changes in cardiovascular functioning. The essentially parallel nature of the recorded variables, from the initiation of the programming through its completion, provides no evidence to substantiate claims for increased systemic functioning. Although disappointing, the observed results may reflect an initial, relatively high (for this population) level of cardiovascular functioning, to the extent that the bouncing provided no adaptive stress for that system. Of the 3 individuals involved in this study, Subject I functions motorically at a much higher level than the other two. During the course of the study, he developed somewhat independent, functional ambulation skills. As a result of practicing those skills his cardiovascular functioning would require a much greater stressor than that which was used as an intervention in the present study.

Subject II

Subject II is a small (30 lbs.) seven year old male who experienced anoxia for an unknown period of time shortly after birth. As a result of low oxygen levels to the brain, he has no functional vision, a history of recurring seizure activity, and other central nervous system disturbances. Seizure activity is controlled using 45 mg/day Phenobarbital and 150 mg/day Dilantin. Central nervous system damage is further evidenced by his spastic quadriplegia which renders him in need of assistance in performing all activities of daily living. Neuro-developmental evaluation revealed the presence of a moderate asymmetrical tonic neck reflex (ATNR), weak extensor thrust reflex, and an absence of protective extensions in any plane. He has normal range of motion in all joints with the exception of the knees where a 10 degree flexion contracture is present bilaterally; head control is non-existent. Evaluation of his motor development indicated that his functional gross motor abilities reflect those of a 2-4 month infant. Subject II experiences uncontrollable contractions of the large extensor muscles although he is generally hypotonic. These muscular contractions are especially evident when his arousal level increases. Motor activity programming produces an elevated arousal level, consequently, it has been necessary to implement relaxation programming. The relaxation programming is moderately effective when accompanied by constant verbal prompting. All programming is performed with Subject II either supine or held by the instructor because of his poor head control.

Subject II was placed supine on the trampoline. The instructor lifted the subject's right knee until the thigh was vertical and the lower leg horizontal. Slight pressure was applied to the outside of the subject's knee, moving it over the subject's midline while the instructor gave verbal cues to roll over (physical guidance was applied as needed). A roll was considered successful when the subject rotated his entire body through 90 degrees and his cheek touched the trampoline bed. Data collection included the success/failure ratio based upon ten trials in either direction, and the telemetered heart rate during the rolling task.

The degrees of success in achieving criterion (completing a rolling maneuver, from back to front, 10 trials each side) are presented in Table 1.

Insert Table 1 about here

Examination of Table 1 reveals that Subject II had essentially achieved criterion to his right side at the beginning of week 4; achievement of criterion bilaterally, was achieved at the beginning of week 5.

Figure 3 is a graphical representation of the relationship between the average time for successfully completed trials and the average heart rate for successfully completed trials.

Insert Figure 3 about here

Inspection of the plots of mean heart rates and mean performance times reveals that these parameters tend to parallel one another. Further examination indicates that there is a steady decrease in both heart rate and performance time at the beginning of week 4. This would indicate an increase in efficiency of movement.

Subject II always begins his activity from a supine position; the task was considered complete when he was lying on his side with his face touching the trampoline. His starting position and ending position are defined; hence, the work done is constant for each roll. If the rolling task is completed more rapidly, then the work done per unit of time increases. Since work done per unit of time is defined as power, there must be a change in power output. Figure 4 is a representation of the power output during the last three weeks of the study.

Insert Figure 4 about here

Power output is proportional to the reciprocal of the time taken to perform the rolls. Since the time to perform the task decreased in the last three weeks of the study, there should be a proportional increase in the power output. The data presented in Figure 4 support this position.

At the beginning of week 4 Subject II had essentially achieved criterion. The observed steady decrease in mean heart rate and mean performance time indicate that there is a concomitant increase in efficiency. (Lower heart rate indicates a lower metabolic demand, despite performing the task more quickly.) Such an observation in a non-handicapped individual would be explained as an increase in the level of physical fitness. It seems reasonable to assume that this is also the case for this subject. Thus the activity appears to have influenced his cardiovascular functioning positively.

Subject III

Subject III is a 5 year 8 month male (58 lbs.) with multiple congential defects including enopthalmos (abnormal retraction of the eye into the orbit) of the left eye; micropthalmia (abnormal smallness of the eye); cataract and coloboma (congenital fissure) of the right eye; moderate deformities of both ear lobes and an absent nasal septum; congenital heart disease (incompletely diagnosed); macrocephaly (excessively large head); and polydactly (presence of supernumary digits) of his hands and feet. Motorically, Subject III appears to have adequate co-contraction patterns in his neck and trunk (usually precursors to head control and balance) however, he has not yet demonstrated any head or neck righting reflexes in response to vertical displacement. Shoulder stability is adequate in that he bears weight on his arms when kneeling on all fours. Protective extension reflexes are present bilaterally.

The physical education activity used in this study involved bouncing on the trampoline in a kneeling position and programming for the development of head and neck righting reflexes; bouncing time and heart rates during bouncing were recorded.

Subject III participated in an independent trampoline bouncing program (3 times weekly) for 6 weeks. Mean performance times and mean heart rates are recorded in Figure 5. Once again, changes in performance are reflected by changes in heart rates, with a gradual, overall decrease in heart rates throughout the course of the experiment, although bounce times increased.

Insert Figure 5 about here

Casual inspection of figure 5 reveals that there is little decrease in this subjects' heart rate over the 5 week period. This information is misleading unless it is interpreted in the light of the mean bouncing time. Although there appears to be only a very small decrease in the heart rate, there is a 100-200 percent increase in the mean bouncing times. The body`s demand for oxygen (all energy expenditure must be explained, ultimately in terms of oxygen consumption) is met by its oxygen transport mechanism. The oxygen transport at any given time is, in part, a function of cardiac output. Since cardiac output is the product of heart rate and stroke volume, and stroke volume is essentially constant at heart rates greater than 120 beats per minute, oxygen transport is proportional to heart rate at heart rates greater than 120 beats per minute. Bouncing for greater periods of time, as evidenced in weeks four and five (Figure 3), required increased metabolic output.The subject appears to meet these increased metabolic demands with no large increase in mean heart rate. Since mean heart rate during the activities for the last two week is greater than 120 beats per minute, we must assume that the bouncing is being performed more efficiently; or that there is some positive change in the oxygen utilization coefficient; or that the activity was of such low metabolic demand that he was working entirely aerobically. Given the degree of involvement of this subject, we believe that the former explanation is more acceptable. Again we conclude that there has been a positive change in Subject III's cardiovascular functioning.

Conclusions

The nature of this population, combined with the difficulties of quantifying the work done, and the non availability of comparative data for similar subjects, forces us to be tentative in our conclusions. However, as a result of this study we believe that gross motor programming can have an observable effect on the cardiovascular functioning of profoundly retarded, multiply-handicapped children. Furthermore, radiotelemetry provides an excellent medium by which gross cardiovascular responses can be monitored in such populations. We hope that the present study will provide the impetus for special physical educators to do more than record performance based data. We think that the physiological benefits ascribed to participation in activities should be tested, and the results of these test procedures used to determine the effectiveness of special physical education programming.

Table 1

Percentage Achievement of Criterion (10 trials each side)

Week	Day	Rolling to Right	Rolling to Left
1	M	60	20
	W	60	40
	F	60	40
2	M	80	20
	W	60	40
	F	80	20
3	M	60	60
	W	100	20
	F	80	60
4	M	80	60
	W	100	60
	F	100	60
5	M	100	100
	W	100	100
	F	100	100
6	M	100	100
	W	100	100
	F	100	100

Figure 1.

Flow diagram of the data collection system used for recording electrocardiogram (ECG) information.

Figure 2.

The relationships between mean heart rate and trampoline bouncing time during the course of the experiment for Subject I.

Figure 3.

The mean times taken to complete ten trials on a rolling task to the left and to the right are presented in relation to mean heart rates achieved during each day of the experiment for Subject II.

Figure 4.

A theoretical treatment of the power output of Subject II during a rolling task to the left and the right during the last three weeks of the experiment.

Figure 5.

Represents the relationship between the mean performance times (bouncing on the trampoline) and the mean heart rates achieved while bouncing, during the course of the experiment for Subject III.

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Footnote

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Consolidation Memory Theory Applied to Relearning Motor Skills in Severely/Profoundly Handicapped Children

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Running head: RELEARNING MOTOR SKILLS

ABSTRACT

"Consolidation Memory Theory Applied to
Relearning Motor Skills in
Severely/Profoundly Handicapped Children"

Submitted March 20, 1984

Abstract

The purpose of the study was to evaluate the effects of latency periods on the retention of gross motor skills in severely/profoundly handicapped children; and to evaluate the efficacy of a relearning model as a test of learning among these children. The study used a quasi-experimental, multiple baseline across subjects design. Subjects were three profoundly handicapped children resident at the Idaho State School for the Deaf and the Blind. The subjects were taught a motor skill which was designed specifically to their abilities; the skill was retaught following latency periods of 90, 30, and 14 days during which time the skill was not practiced.

Based upon the results of this study it was concluded that the subjects had some ability to retrieve motor programs; and, that there was some feedback process in operation serving to refine the motor program. These findings would not have been observed using traditional methods of testing learning, such as tests of recognition or tests of recall. It was determined that the number of trials required to achieve a criterion is dependent upon the latency interval, with a 14 day interval having no effect upon achievement of criterion. These findings are used to support an argument for intermittent programming for the retention of motor skills in severely/profoundly handicapped children, thereby, their repertoire of behaviors could be maintained and expanded.

Key words

Consolidation memory theory; relearning; motor skills; severely/profoundly handicapped.

Man's behavior and his motor acts are, in large part, a product of the efficiency of the perceptual/afferent processes which precede them and upon which they are based. There are at least three stages to the learning-memory process. First, as information is received via sensory modalities, it is transduced at the receptor to a physiological representation, and stored briefly in a sensory system. There is an abundance of evidence indicating that information is retained in such a sensory store for two-three seconds for vision, and up to fifteen seconds for the other sensory modalities, (Averback & Spelling, 1961: Posner & Konick, 1966). The information is then transformed into a new code and retained for a short period in another storage system, known as the short term memory (STM). The second stage (STM) is of a relatively short duration, with the trace of the experience being maintained by a "transient reverberating process" (Sage, 1977). Before this reverberating trace disappears, it initiates a short lived electrochemical process which leads to the consolidation of the "memory trace" in the form of a structural modification of the nervous system. This third stage is hypothesized to be some specific biochemical or structural alteration in the neurons. This concept of a three stage memory process that includes the storage of information at the receptor as some form of dynamic electrical activity, and the subsequent structural modification of the nervous system resulting in long term memory, commonly, is referred to as the Consolidation Memory Theory.

The Consolidation Memory Theory was originally hypothesized by Muller and Pilzecker (1900), and more recently supported by Hebb (1949), Konorski (1967), and Eccles (1973). Investigations of the consolidation memory theory have implied collectively that the sensory process consists of an intricate series of electrical events, which, if subjected to interference during the short-term memory phase, will result in the dysfunction of the long term memory process. The effects of such disruptions in the short term memory stage or process is evidenced in numerous studies where electrical, chemical or other disturbing variables were introduced during the learning of specific tasks.

Experiments in which electroconvulsive shock was applied shortly after the learning experience, to both animals and humans, have demonstrated the effects of disruptive stimuli on the learning process (Halstead & Rucker, 1968). Similar investigations in which anesthetic and convulsant drugs were administered to animals shortly after the instructional period also produced detrimental effects on the learning and retention process (McGaugh, 1965; Overton, 1969).

It is evident that the retention of information over extended periods of time is a phenomenon that is sensitive to numerous extrinsic and intrinsic factors including drugs, sensory acquity, and nervous system maturation and efficiency. As result of the general nature and needs of the severely/profoundly retarded, it would seem reasonable to infer that these children may experience significant problems in the learning process which may be the result of various medications, sensory dysfunctions or an immature central nervous system.

Measurement of both qualitative and quantitative dimensions of retained information is a common concern of educators and professionals involved with developing behaviors in severely/profoundly handicapped children. Usually the evaluation of learning is achieved by measuring performance on tests of recall or tests of recognition. However, when working with the severely/profoundly handicapped, tests of recall or tests of recognition often register zero, especially if the individuals are tested after some extended latency period when the skill was not practiced. After evaluating recall or recognition test scores, teachers often may be tempted to conclude that learning has not taken place. However, a much more sensitive measure of learning, than either recall or recognition is available, and it may provide more valid and descriptive information from handicapped populations. Relearning or the "savings" technique involves tabulating the number of trials the learner requires to reach a certain level of proficiency, then after some retention interval when the skill was not practiced, the number of trials required for the learner to again reach criterion are recorded. The difference between the original number of trials and the number of trials following the retention interval is considered the retention "savings." Using this technique, if a learner required 100 trials to attain the criterion of 10 target hits out of 10 trials, and then required 40 trials after the retention interval, the savings is 60 trials or 60%.

The purpose of this study was to evaluate the effects of latency periods of 90, 30, and 14 days on the retention of gross motor skills in a population of severely/profoundly handicapped children; and to evaluate the efficacy of the relearning model as a test of learning among these children.

Method

A quasi experimental, multiple baseline across subjects design was selected for use in this study. Rationale for using a design of this type has been adequately discussed elsewhere. (Allport, 1962; Bergin & Strupp, 1970; Baer, Wolf & Risley, 1968).

Subjects for this study were three profoundly handicapped students at the Idaho State School for the Deaf and the Blind during the academic year 1983-84.

Subject I

Henry is a 22 year old male with behaviors and abilities characteristic of classic rubella syndrome. He is small (92 lbs.), exhibits general hypotonia, and experiences seizures as the result of neurological dysfunctions. Seizure activity is controlled using 200 mg/per day Dilantin, 90 mg/day Phenobarbital, and 400 mg/day Tegratol. Henry demonstrates no functional vision, is unable to ambulate independently, but has hearing within normal limits; as a result of the medications Henry is generally in a state of lethargy.

Subject II

Danny is a spastic quadraplegic; he is seven years old, and weights 30 lbs. His quadraplegia is a result of postnatal anoxia, he has no functional vision, and a history of recurring seizures and other central nervous system disturbances. Seizure activity is controlled using 45 mg/day Phenobarbital, and 150 mg/day Dilantin. Danny experiences uncontrollable contractions of the large extensor muscles although he is generally hypotonic.

Subject III

Jeannie is 10½ year old female with diagnosed Sturge-Webber syndrome (port-wine nevi along the distribution of the trigeminal nerve on the left side of her face, intracranial calcification, severe mental retardation, epileptic seizures), psychomotor retardation, and cortical blindness. Her medications include 200 mg/day Phenobarbital and 400 mg/day Poly-vi-flor. She functions at the 6-8 month level in gross-motor skills; is unable to stand without support but can ambulate in a hammock-swing four point walker.

A gross motor skill was selected for each of the three subjects in the study. These motor programs were integral parts of each child's total individual education plan, and thus fulfilled objectives identified by the child study team. The activity selected for Henry was a bouncing activity in a supine position on a trampoline. The specific objective used as the criterion for Henry was as follows: "Henry will bounce in a supine position on the trampoline for 10 trials of 24 seconds each, with a 30 second recovery interval between each trial, for 3 consecutive trial days." Data recorded to evaluate learning/retention was time of performance.

Danny's performance objective consisted of an independent rolling program, more specifically, stated as: "From a supine position with physical and verbal prompts Danny will roll through 90° until his face contacts the trampoline; this behavior will be performed at 80% efficiency bilaterally for 10 trials on 3 consecutive days. (Successful completion of 8 out of 10 trials). Data for Danny consisted of the percent achievement of the performance criterion.

Jeannie had demonstrated a self-stimulation behavior of rocking. It was reasoned that the behavior could be used as the basis for a gross motor skill program. The motor skill program designed for Jeannie fulfilled the objective stated below: "While supported on a rocking horse Jeannie will initiate and maintain a rocking motion (in the sagittal plane) while continuous physical and verbal prompting is applied, for 5 trials of 30 seconds each. The time of performance was used as the data to determine if learning was taking place.

The study was conducted over a period of 10 months, and in three phases following the initial learning of the skill. Each phase consisted of two parts. The first part was a latency period during which time the gross motor skill was not practiced, while the second part was the relearning of the skill until the subject achieved criterion performance. The three phases were systematically designed to provide data concerning the effects of the length of the latency period on retention as measured by relearning.

Latency intervals of 90 days, 30 days, and 14 days were selected for use in this study.

Results

Figure 1, 2, and 3 illustrate the initial learning rates and the relearning rates of three subjects following latency periods of 90, 30, and 14 days.

Insert Figures 1, 2, & 3 about here

All three sets of data follow the same general pattern; there is a dramatic decrease in the number of intervention days required to achieve criterion as the length of the latency period decreased, with the exception of the first relearning phase for Danny (see Figure 3). Indeed, the 14 day latency period appeared to have no effect on the retention of the motor skill; all three subjects reached criterion on the first three trials. In all instances the level of skill performance at the beginning of a relearning phase was higher than in the previous exposure to skill learning. If learning rate is given by the gradient of the learning plot, it appears that there is little change in the rate of learning following the latency period, rather the decrease in the number of intervention days to reach criterion results from the starting point in relation to criterion, rather than some dramatic change in the rate of learning the motor skill.

Conclusions

Although the early re-learning trials in phases I and II were not a criterion, the performance of each subject during these phases was higher than the initial performance or the performance in the beginning of the previous re-learning phase. Across all subjects, each period from the beginning of re-learning to attainment of criterion required fewer trials than did the original learning phase; further, the period of time from the onset of relearning to criterion is relative to the length of the latency interval. More explicitly, the shorter the latency interval, the shorter the re-learning to criterion period. The relearning process for this population is a more sensitive and descriptive evaluation mechanism than either tests of recall or tests of recognition. It appears that the subjects had some ability to retrieve the appropriate motor program from their storage mechanism; and there was some type of feedback process in operation serving to amend incorrect movements.

Figures 1, 2, & 3 illustrate the effects of three latency periods on the re-learning of motor skills which were previously performed at some criterion level. Throughout re-learning phases I and II, it was observed that there were numerous extraneous movements both preceding and integrated within the performance of the skill. Several of these behaviors appeared to "work against" the overall goal of the motor plan. It appeared that the order of the many sub-routines in the motor programs were often confused, resulting in correct motor behaviors being inserted at inappropriate times. Examining these observations, using the theoretical framework of the Consolidation Memory Theory, we concluded that the stored trace (memory trace) of the components of the skill, had become less defined, resulting in disorganized and in inaccurate responses in both temporal and spatial aspects of the motor program, as time without practice increased. Furthermore, it appeared that, as the motor program became inaccurate, inappropriate behaviors were no longer omitted. Again, this may be interpreted as a weakening of the stored trace of the activity, with random behaviors reflecting the inefficiency of the hierarchical control centers of the central nervous system.

An important observation regarding Figure 2, (Danny), must also be addressed at this time. During the initial learning phase of the rolling program, significant physical assistance was needed in order for Danny to perform the task. However, during the latter portion of the initial learning period, the need for physical assistance decreased, as a physical prompt was incorporated into the intervention plan. During all further learning and re-learning phases the physical prompt was used to facilitate performance. This may account for any similarities in the positive accelerations between the initial learning phase and re-learning phase I, that appear in Figure 2.

In re-learning phase III, all subjects performed at criterion levels on the initial intervention trial of that period, despite the 14 day latency interval. Thus it would seem that a 14 day retention interval has no effect on the quantitative or qualitative aspects of the previously learned motor task. Overall it appeared that all subjects had the necessary abilities to retrieve previously stored motor programs, with latency intervals of up to 90 days. After review of figures 1, 2, and 3, it became apparent that retention intervals of up to 30 days had little effect on this population's ability to perform previously learned motor tasks.

There are a variety of factors that may affect this population's performance on tests of re-learning. It seems reasonable to suggest, in light of the previously discussed effects of certain drugs on the learning process, that the execution of the motor program in this population may be effected by the various medications used to control seizures and maintain other bodily functions. In addition, the retention of the motor skill trace may be affected by other dysfunctions in sensory discrimination and acquity, or perhaps by the level of sensory system maturation. It may be hypothesized also that the intrinsic motor feedback loops may be dysfunctioning to produce inappropriate motor responses resulting in the need for greater amounts of time for the error detection process to operate.

In summation, it appears that there are a variety of potential factors that may have affected the retention of the motor skills in this population of children. However, each of the subjects in this study demonstrated some retention capabilities, regardless of the latency interval. Furthermore, such data may provide an impetus for professionals in similar educational environments, who are concerned with the long term benefits of their educational interventions. It appears that programming is beneficial, with this population having the ability to store certain motor programs for extended periods of time. Utilizing this concept, we may develop and implement intervention procedures which, after criterion performance is attained, use latency intervals of up to 30 days after which time the tasks would be "re-learned" in only a few trials. As a result, a greater portion of the programming day could be used to develop other programs in the educational plan of the severely/ profoundly handicapped child. Thus, the repertoire of behaviors in this population of children could be maintained and expanded.

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Footnote

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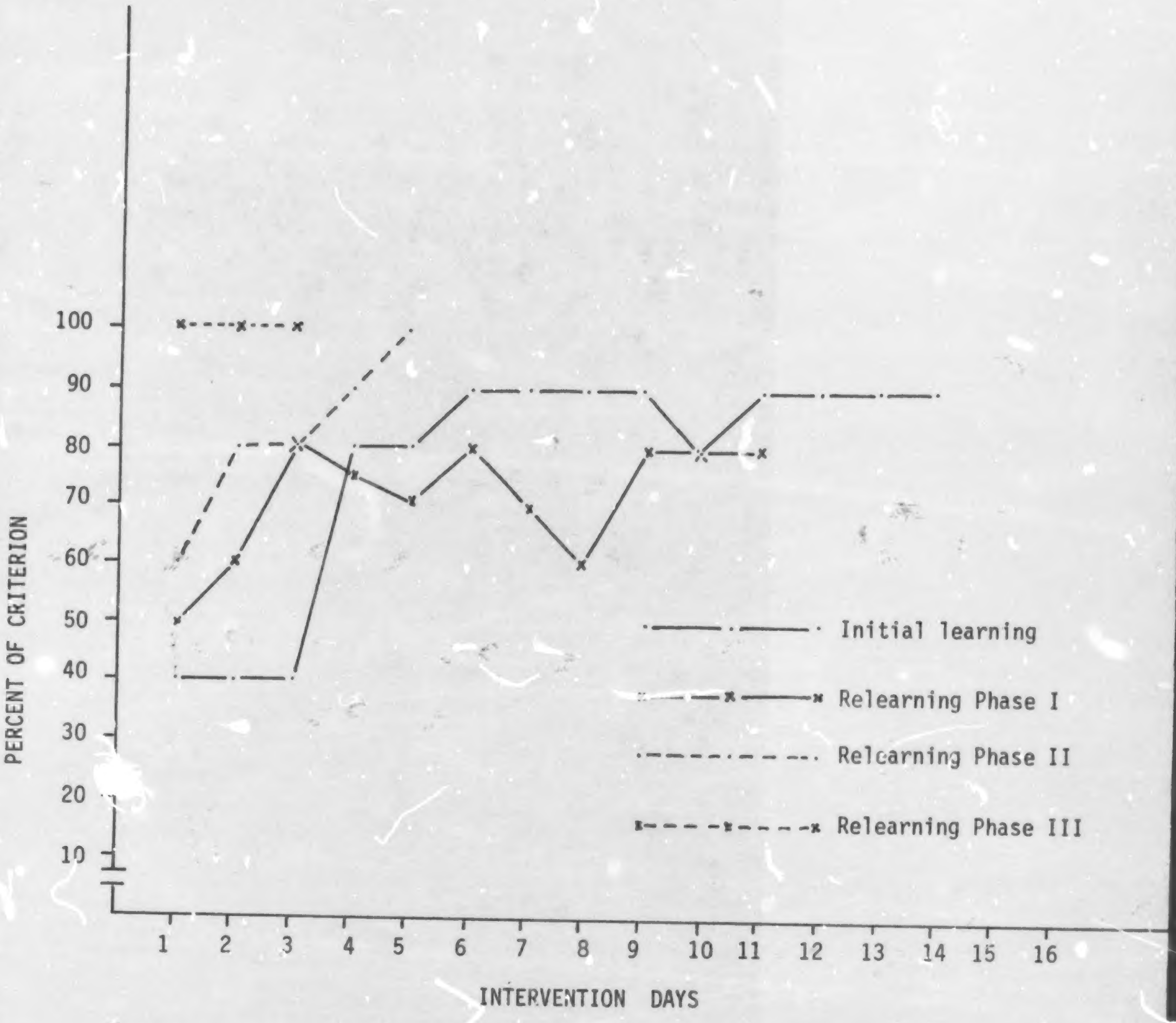
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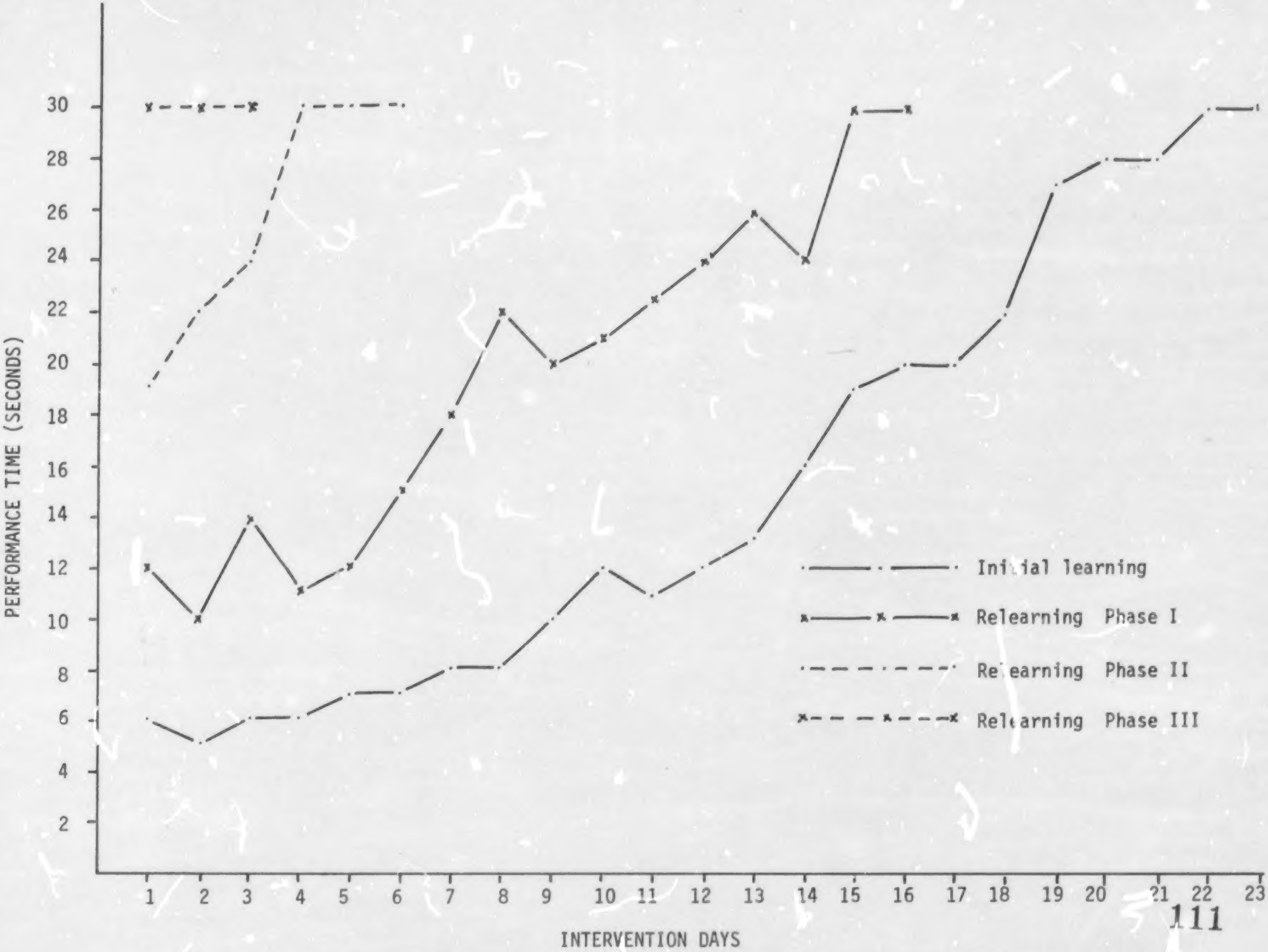
INTERVENTION DAYS
Initial learning
Relearning Phase I
Relearning Phase II
Relearning Phase III

figure II


PERFORMANCE TIME (SECONDS)
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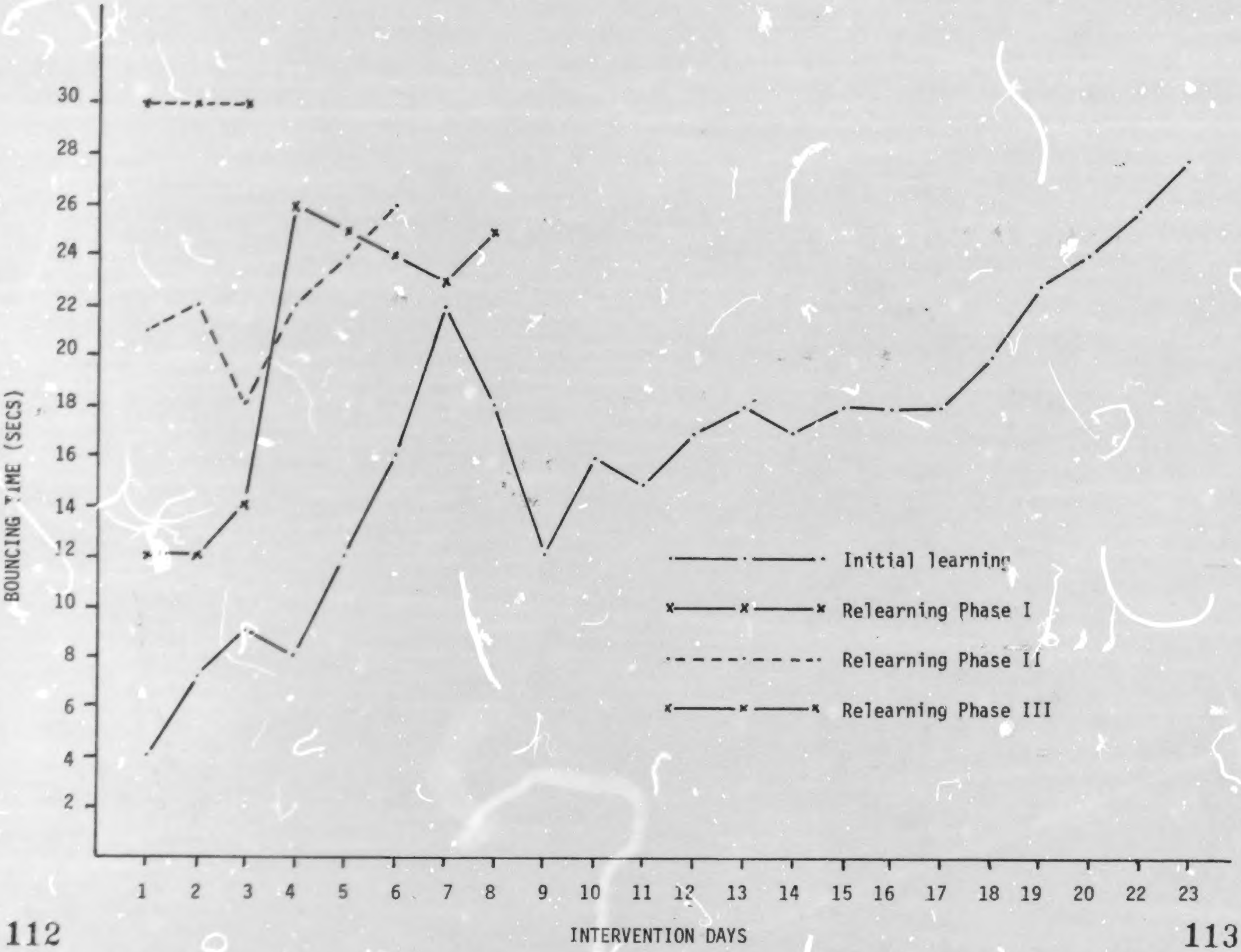
INTERVENTION DAYS
Initial learning
Relearning Phase I
Relearning Phase II
Relearning Phase III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INTERVENTION DAYS
Initial learning
Relearning Phase I
Relearning Phase II
Relearning Phase III

Figure 1

The Effects of Systematic Ambulation Training on the Cardiovascular Responses of Severely/Profoundly Handicapped Children

by

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and

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Running head: Ambulation

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"The Effects of Systematic Ambulation Training on the Cardiovascular Responses of Severely/Profoundly Handicapped Children"

Submitted

April 10, 1984

Abstract

The purpose of the study was to evaluate the heart rate response of three severely/profoundly handicapped children as they participated in systematic ambulation training; all three subjects used different modes of ambulation. The study was conducted over a period of six weeks with heart rate responses recorded during the initial 20 seconds of recovery following performance at established criterion levels.

Based upon the results of this study it was concluded that all three subjects demonstrated learning (decreased performance time or decreased variability of performance time) for their respective ambulation skills.

Furthermore, that ambulation training can make a positive change in the cardiovascular functioning of severely/profoundly handicapped children, provided that the programming is applied in a systematic manner.

Key Words

Severely/profoundly handicapped; ambulation; cardiovascular; heart rate; systematic observation.

Functional ambulation in children is a developmental process beginning with the reptilian like crawling of the four month old infant initiated via the Symmetrical Tonic Neck Reflex (STNR). It continues with the cruising behaviors of the one year old, and the eight year olds acquisition of the other fundamental motor skills such as running, hopping, skipping and galloping. This sequence generally occurs on a predictable timetable and serves as a means for the development of muscular strength and endurance along with concomitant increases in the child's cardiorespiratory capacities. However, for those children who experience mental or motoric retardation these skills develop at a much later time, if in fact they ever appear. The inability to acquire these functional skills results in the child's long term inability to receive the established health related benefits that result from normal movement activities.

Recent trends in educational programming for handicapped children address this population's need for specialized physical education. The result has been a variety of adapted physical education and motor therapy programs. Public schools have initiated specialized physical education classes for severely and profoundly handicapped students, (Broadhead 1981; Wehman & Marchant, 1977), and, in some instances, have integrated severely/profoundly handicapped children into regular physical education classes, (Santomier & Kopczuk, 1981). There are a variety of other programs currently offered, such as public school based adapted athletics, community based recreational programs, and the Special Olympics. Each may serve as a source for physical education or physical fitness activities. Although these innovative program trends have served as a means of teaching physical fitness activities to the severely/profoundly retarded, there is a dearth of empirical data concerning the physiological responses of this population as they participate in such activities.

The purpose of this study was to evaluate a selected cardiovascular response of three severely/profoundly handicapped children as they participated in individualized motor training programs that were based on their current mode of ambulation.

Method

Three severely/profoundly handicapped children, all residents of the Idaho State School for the Deaf and the Blind (ISSDB), participated in this investigation. Two of the participants were within the (AAMD's) classification category of severely/profoundly mentally retarded. The third subject, while functioning in the mildly retarded range of the AAMD's classification system also had spastic quadraplegia requiring the use of a wheelchair for ambulation.

Subject I

The first subject is George, a ten year old male who was born premature (6½ month gestation), the product of a twin pregnancy to a gravida one mother. He suffered respiratory distress syndrome immediately after birth and remained hospitalized for two months. During this time he developed hydrocephalus associated with a left side cystic lesion of the brain. Although a shunt procedure was not performed, the hydrocephalus was beginning to be arrested at about one year of age and was further treated for approximately two years. At three years of age George experienced what appeared to be a stroke and has since exhibited decreased strength, and a decline in the functional use of his left side; he is unable to stand, unable to grasp objects with his left hand, and has lost all but a few remnants of his pre-stroke vocabulary of 20-30 words. Neurological evaluation revealed cranial nerves 2-12 grossly intact with brisk tendon reflexes on the right side, and very brisk on the left side. George has approximately a 10 degree flexion contracture of the hip and knee, with tight heel cords bilaterally, although range of motion at the ankles is still within normal limits. There is evidence of increased tonus of the hip adductor musculture with passive abduction being approximately 45 degrees bilaterally. Decreased muscle mass of the left upper and right lower extremities is also apparent when compared bilaterally. Motorically, George rolls and sits independently, although most of the time he is in a "W" sitting posture when upright. He is able to stand only with total support; when he stands it is in an extreme scissor position.

Observation:

As result of the flexion contractures, ambulation in the form of walking is not attainable. A crawling program focused upon providing George with the skills necessary to move through, and to interact with his environment. Essentially, this program allows George to move in a position of constant hip and knee flexion while bearing weight on both hands and the lateral aspects of his right hip, leg and knee. His movement appears to be more of a slide than a crawl; his hands/arms reach out and are placed approximately 18 inches from his body, he then slides his trunk, hips and legs to his hands.

Consideration was also given to maintaining or increasing George's cardiorespiratory capacities through the performance of his motor program. The original baseline motor program consisted of placing him in a modified "W" sit on the floor and recording the time required to crawl a distance of 30 feet to reach a rewarding stimulus (a ball). Heart rate was recorded during the initial 20 seconds of recovery. A continuous verbal prompt was used throughout the trials. Data were recorded on three consecutive intervention days, and an objective defined which included the parameters of distance (15 feet), and time (60 seconds or less), to permit accurate evaluation of his performance and progress.

Subject II

The second subject is Carol, a thirteen year old female, who is the product of a premature birth with an unknown gestation period (birth weight 2 lbs. 10 oz.), she is severely/profoundly mentally retarded with spastic hemipareisis of the left side; retrolental fibroplasia resulting in total blindness; and a porencephalic cyst on her right cerebral hemisphere. Neurological evaluation determined that cranial nerves 2-12 were essentially intact. Her left lower extremity is approximately three centimeters shorter than her right when measured from the anterior superior spine of the ilium to the medial malleous. She exhibits approximately a 10-15 degree flexion contracture at both the hip and the knee. Passive dorsiflexion of the left foot is accomplished to 10 degrees with the knee extended and 24-30 degrees with the knee flexed. Her cardiopulmonary systems are intact.

Observation:

Although Carol experiences significant neurological, motor and orthopedic dysfunctions, ambulation is possible with the aid of a one-hand assist or a four point walker. Flexion contractures of the left hip and knee have rotated the left leg 10-15 degrees medially resulting in a slight subluxation of the left acetabulum. Recent orthopedic evaluation indicates the potential for total hip restructuring when physical maturation has occurred.

Among the long term goals identified by the child study team (whose members include an orthopedist, physical therapist and family physician), was the development and maintenance of her ambulation to some functional degree, along with increasing her cardio-respiratory endurance.

The original intervention program for ambulation and cardiorespiratory endurance consisted of Carol walking (with one hand assist) for a period of 60 seconds. The task objective was developed from the baseline data to include walking a distance of 60 feet, with the time of performance and heart rate during the first 20 seconds of recovery being recorded.

Subject III

Tom is an eleven year old male, a product of a premature birth (28 week gestation), with a birth weight of 3 lb. 6 oz. His medical and physical abnormalities included: an early history of petit mal seizure activity, infectuous hepatitis at 10 years of age, recurrent respiratory infections, and cerebellar disturbances resulting in spastic quadraplegia. He currently functions cognitively at a mildly retarded level. Examination of Tom's visual systems revealed an exophoria of the left eye with the fundi being poorly visible. Intervention was performed early in Tom's life to alleviate the contractures of his hips by surgically severing the hip flexors leaving him with little ability in weight bearing and ambulation. He is confined to a wheelchair, although some programming may require his placement either in a straight backed chair or prone/supine on the floor. Socially, Tom relates well with his peers but has some behavioral problems in response to authority. He can communicate verbally sufficiently to indicate his needs.

Observation:

Until a few years ago little emphasis was given to developing a sense of independence and normalcy in Tom. However, recent child study team meetings have addressed this concern resulting in efforts to develop his independence. Several programs were developed to facilitate this process including: training in personal hygiene; the development of independent transfer techniques allowing for independent use of the restrooms; and activities to increase his wheelchair mobility and cardio-respiratory endurance.

A training program of wheelchair mobility was developed requiring Tom to propel himself a distance of 60 feet across a carpeted floor inside the hallway of his school building. Five trials a day were performed with data recorded on both the times of performance and his heart rate during the first 20 seconds of recovery.

Results

Figure 1 presents an overall picture of George's physiological responses prior to participation in the crawling program and his heart rate responses during the seven weeks of the study.

Insert Figure 1 about here

Initially, (baseline data) George's time to crawl 15 feet exceeded four minutes. However, during the course of baseline data collection his time improved rapidly to approximately 92 seconds. Heart rate responses for these baseline observations were all between 139-142 beats/min. As the educational program was implemented (wk 1) George continued to improve his time to criterion. This trend continued through week two. During weeks 3 and 4 there was a steady decrease in performance with a 60% increase in time from that which was achieved at the end of week two. Weeks 5, 6, and 7 appear to have produced a consolidation of the learning that occurred in weeks 1 and 2, with the time to criterion reaching approximately 67 seconds. Heart rate responses during the first 20 seconds of recovery after each trial appear to remain essentially constant (140 ± 3/beats/min), until the beginning of week 6 when there is the beginning of a dramatic decrease in recovery heart rate.

Figure 2 represents performance data for Carol.

Insert Figure 2 about here

Heart rates during the first 20 seconds of recovery, are recorded in relation to distance traveled; initially, no constraints were placed on time. The criterion task selected as Carol's motor program, was a fifty foot walk to be completed within 60 seconds. Examination of Figure 2 reveals that Carol barely achieved criterion in the first week of programming. Thereafter there is a marked and steady decrease in the time to achieve criterion. By the end of the 5th week the plot for mean performance time is becoming asymptotic with time equal to 30 seconds. Evaluation of the heart rate plot reveals that the heart rate remains reasonably constant (hr = 132 ± 4 beats/min) with the exception of the observations made at the beginning of week 5.

Tom's motor programming consisted of propelling his wheelchair 50 feet in 60 seconds (for 5 trials). Mean heart rates during the first 20 seconds of recovery and mean time required to achieve performance criterion are presented in Figure 3. These data

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Insert Figure 3 about here

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are mostly unremarkable. Although there was a 30% decrease in heart rate in the first two weeks of participation, subsequent measurements show a steady increase. Average time required to achieve criterion performance remained essentially the same throughout the study.

Discussion

Inspection of Figures 1, 2 and 3 suggest that classical learning patterns are common in severely/profoundly handicapped children. All three subjects demonstrated decreases in time to criterion over the course of this study.

Non-handicapped individuals often show periods of learning then appear to regress; George exhibited this phenomenon (intervention days 6-10), and Tom also appeared to regress on intervention day 6. Individual differences among observations on different days probably reflect a variety of extrinsic influences, eg. medications, motivation, etc. These influences are particularly pervasive in an institutional setting.

Although heart rate responses observed in Figure 1 appear to remain quite stable, the overall decrease in performance time would require George to increase his energy output per unit of time in the educational program. This increased metabolic rate would require increased oxygen consumption. Heart rate and oxygen consumption are linearly related for sub-maximal work loads, when the heart rate is greater than 120 beats/minute, and less than approximately 80% of maximum oxygen uptake. Hence, since the time to criterion was steadily reduced we might have expected to observe a steady increase in heart rate. This was not the case. Indeed, in the final two weeks of the study heart rate began to dramatically decrease. These observations may be explained, in part by George's body adapting to the exercise and using the available oxygen more efficiently.

The data recorded for Carol (see Figure 2), again illustrates that learning was occuring during the course of the motor programming. She effectively reduced her mean time to criterion by 50% over the course of the 5 week period. Her walking gait became more rapid but the pattern remained unchanged. Since the physiological work done is dependent upon the energy output required to move Carol through 50 feet for 5 trials, this decrease in performance time requires an increase in her metabolic rate. We have already discussed how this increased metabolic rate will require additional oxygen utilization. The increased metabolic demands were not reflected in the mean heart rate during recovery. Therefore it seems reasonable to assume that there has been an increase in Carol's cardio-vascular efficiency. The heart rate recorded the beginning of week 5 probably is an artifact reflecting the influence of some extraneous variable.

As previously mentioned, the data recorded for Tom are quite unremarkable. However, two observations require explanation. The other subjects exhibited decreases in the times to achieve criterion performance. In Tom's case there is no decrease in the mean time required to achieve criterion, however, the increased consistency that was demonstrated must be viewed as positive learning. The heart rates observed during this 6 week program do not appear to have any logical explanation, in terms of the physical work demanded by the motor programing.

Motivating Tom to participate in the program was a constant problem faced by the experimentors. It is our belief that his behavioral problems are manifested in the mean heart rate responses and are masking the data and confounding the interpretation.

Conclusions

The purpose of this paper was to evaluate the effects of individualized motor training programs on the cardiovascular systems of severely/ profoundly handicapped children. Based on the results of this study we have demonstrated that ambulation training can make a positive change in the cardiovascular functioning of these children , provided that the programing is applied in a systematic manner over an extended period of time. Furthermore, we believe that many educational programs that are not traditionally viewed as adapted physical education activities have significant potential for influencing the systemic functioning of these children.

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Footnote

This study represents the results of one aspect of project AEROBIC (Aerobic Exercise and Research Opportunities to Benefit Impaired Children); the project was supported under field initiated research by the U.s. Office of Education. The authors would like to express their sincere appreciation to the superintendent, the administrative staff, the faculty and the students at the Idaho State School for the Deaf and the Blind for their participation and encouragement throughout the project.

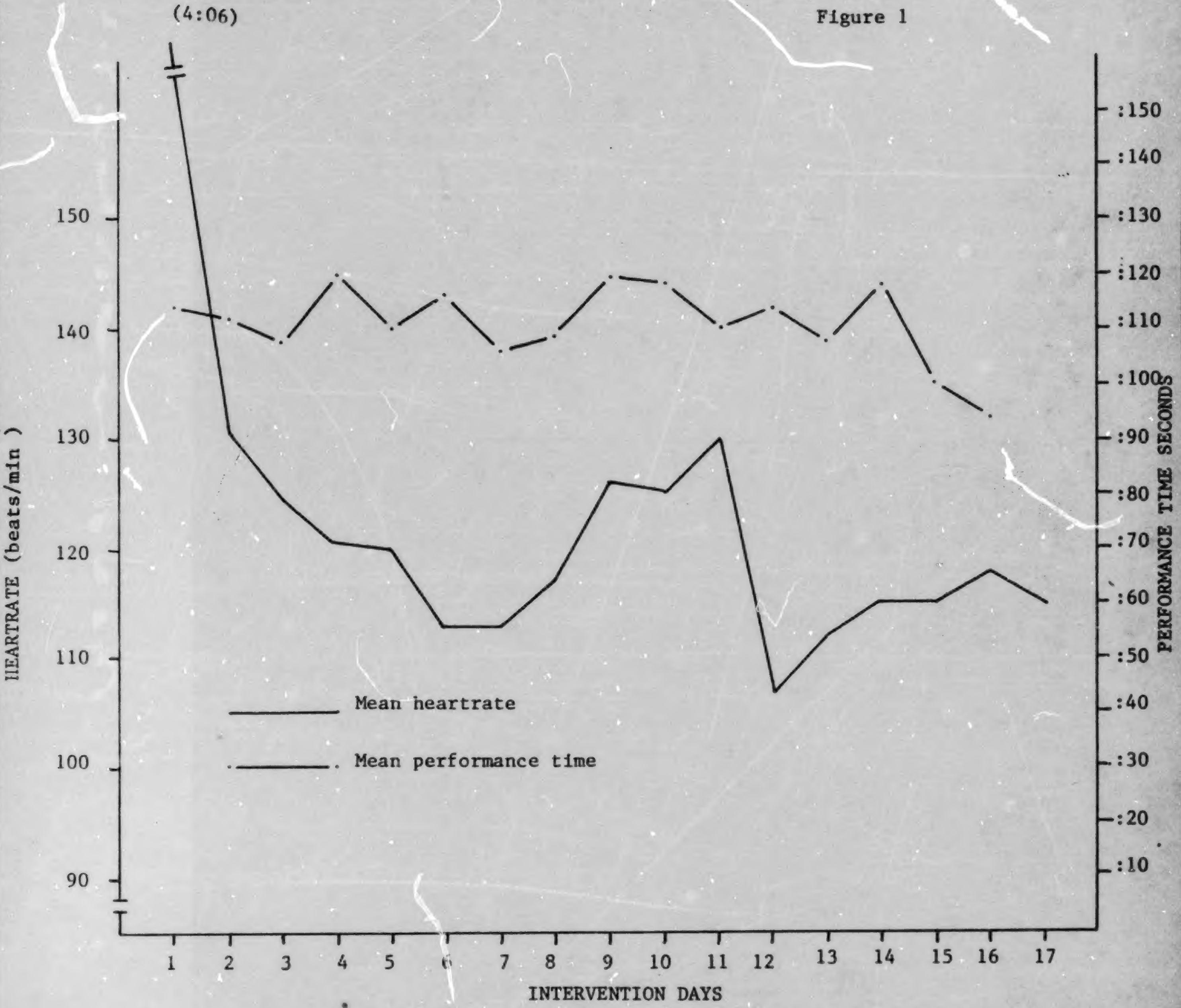
FIGURE LEGENDS

Figure 1. Mean performance times, and heart rates recorded during the first 20 seconds of recovery for subject 1 crawling a distance of 15' feet in 60 seconds or less.

Figure 2. Mean performance times, and heart rates recorded in the first 20 seconds of recovery for subject 2 who walked 60 feet in 60 seconds or less.

Figure 3. Mean performance times, and heart rates recorded for subject 3 who propelled himself 60' in his wheelchair in less than 60 seconds.

Figure 1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HEARTRATE (beats/min)
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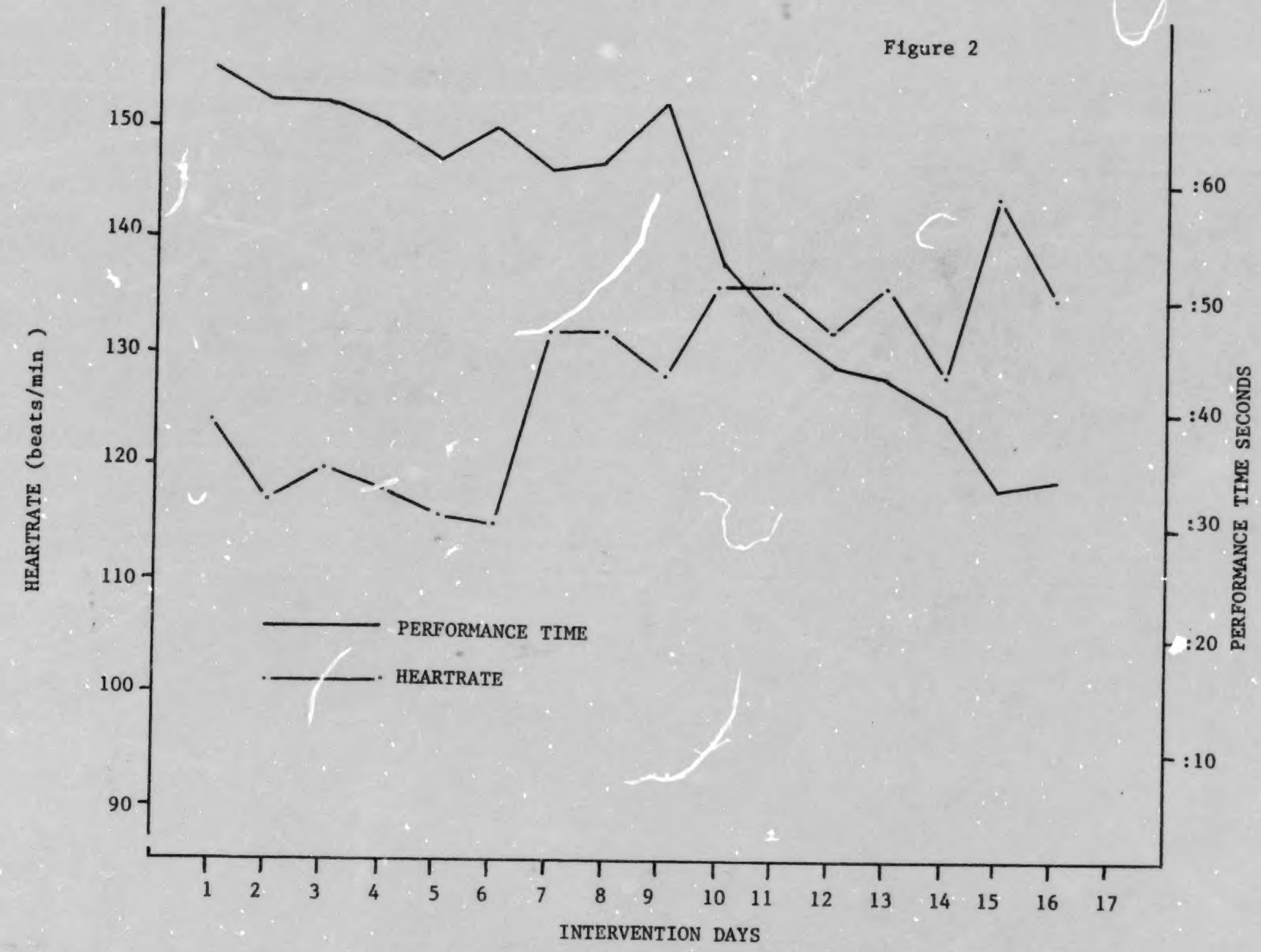
INTERVENTION DAYS
Mean heartrate
Mean performance time

Figure 2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INTERVENTION DAYS
PERFORMANCE TIME
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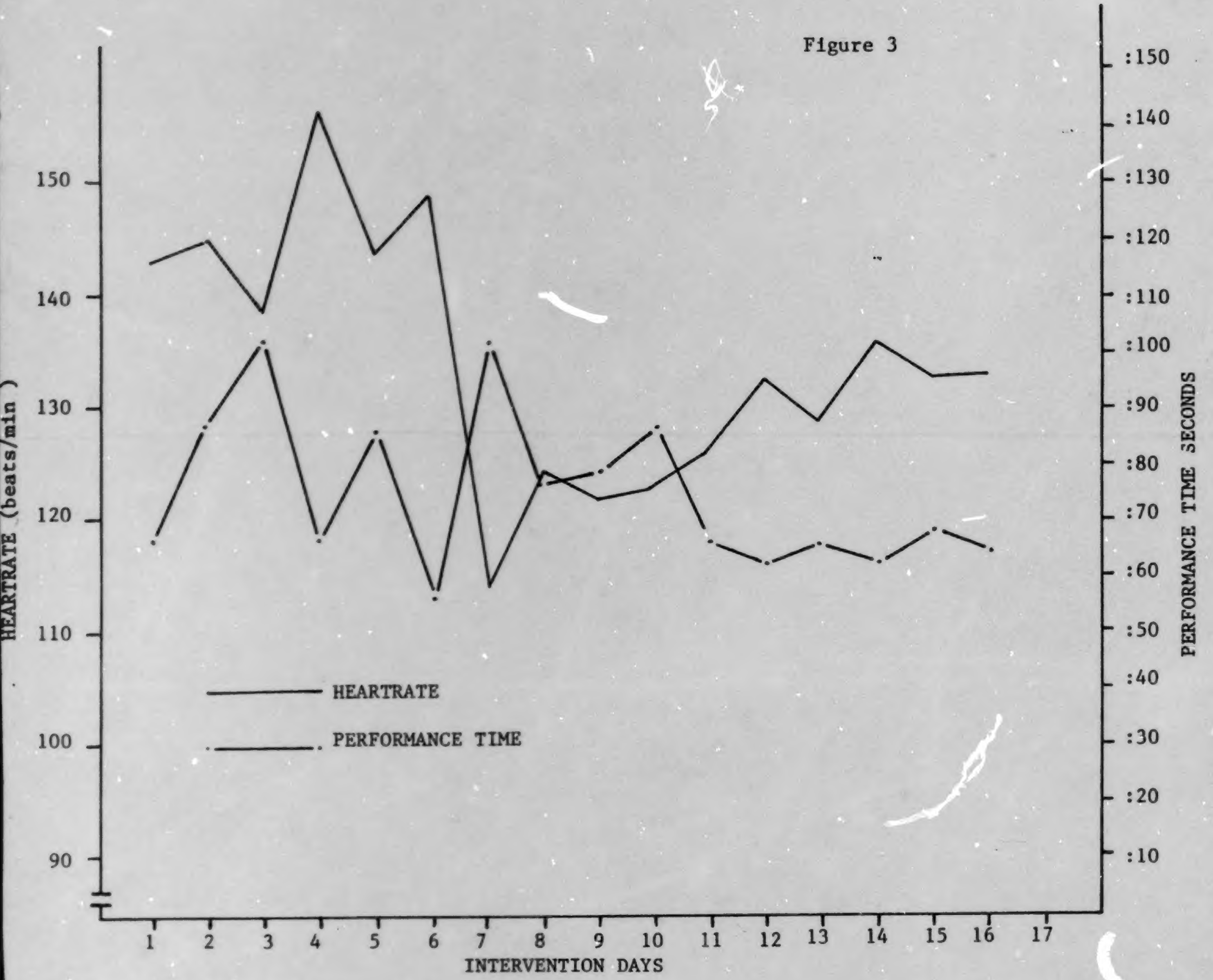
Figure 3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INTERVENTION DAYS
HEARTRATE
PERFORMANCE TIME

FIGURE LEGENDS

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Figure 2. Mean performance times, and heart rates recorded in the first 20 seconds of recovery for subject 2 who walked 60 feet in 60 seconds or less.

Figure 3. Mean performance times, and heart rates recorded for subject 3 who propelled himself 60' in his wheelchair in less than 60 seconds.

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Heart Rate Responses of Profoundly Handicapped Children During Closed-Skill Fine Motor and Open-Skill Gross Motor Activities

by

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Running head: HEART RATE RESPONSES

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Alexander W. McNeill has a Ph.D. in Exercise Physiology and Biomechanics and is a coinvestigator with Mr. Mulholland in Project AEROBIC.

Abstract

"Heart Rate Responses of
Profoundly Handicapped Children During
Closed-Skill, Fine Motor and Open-Skill, Gross Motor Activities"

Submitted April 15, 1984

Abstract

The purpose of this study was to compare the heart rate responses of two profoundly handicapped children during the performance of closed-skill fine motor activities, and open-skill gross motor activities. The fine motor skills were typical classroom activities and the gross motor skills were a part of each child's special physical education programming. A single subject repeated measures design was selected for use in this study. Heart rates were recorded for 20 second intervals from the onset of the performance of each skill until the task objective was obtained using radio telemetered electrocardiograms.

Based upon the results of this study we concluded that the closed skill fine motor classroom activities introduce physiological stress at levels never before suspected. It is suggested that the dramatic heart rate responses may result from a hyposenstive condition of the spindle afferents, the gamma efferents, and the kinesthetic joint receptors; or from a breakdown in the retrieval of the stored motor program resulting in inappropriate spatial and temporal summation. These findings are used to suggest that classroom learning programs may need to be redesigned to accommodate for fatigue.

Key words

Profoundly handicapped, heart rate; closed-skill fine motor; open-skill gross motor; classroom activities; motor programming.

The education of severely/profoundly handicapped individuals may be viewed as a multi-faceted process that uses systematic techniques to facilitate the learning of certain behaviors. Educational programming is generally determined by an evaluation of such children using some criterion based, developmental assessment, to identify the level of the child's communication skills, sensori-motor maturation, and adaptive behavior. Through such proceses, instructional packages are designed for the teaching of functional behaviors, (e.g. feeding head/trunk control and rolling); communication skills; and ambulation.

As result of the various sensori-motor, neurological and structural deviations in these children, much of the educational programming involves the development of some type of purposeful motor behavior, e.g. reaching out to a communication board, touching a head switch, grasping a feeding implement, or performing some type of hand to mouth pattern. Generally, all of these behaviors are taught through a systematic intervention process and data is kept on performance to criterion. The data may reflect efficiency using the ratio of the number of successes to the number of trials; or time of performance; or the degree of physical guidance necessary; or the amount and type of non-associated movement. However, little information is recorded regarding the effects of such activities on aspects of the systemic functioning of this population.

A recent investigation of heart rate responses of profoundly handicapped children while performing gross motor activities reported that such activities do provide sufficient physiological stress to elevate heart-rates, and influence cardiovascular efficiency (Mulholland & McNeill, 1984). During the course of the experiment we observed that physiological work, as measured by elevations in heart rate, was not directly proportional to the magnitude of the observed motor output. More explicitly, increases in heart rates were often noted immediately prior to any observable motor activity; and the heart rates remained elevated throughout the performance of the task. Further observation indicated that extraneous movements present in the performance of the gross motor skill may have elevated heart rates more than the actual performance of the skill. It also appeared that closed skills (those movements with precise beginnings and endings) performed in a predictable environment had dramatic effects on the heart rates of the performers, when compared with heart rates from the performance of the open skills where the environment was unpredictable. Although performance of certain gross motor tasks does elevate heart rates in this population, an equally significant stressor may be the performance of fine-motor, discrete closed-skill tasks. It seems reasonable to suggest that the neurophysiological organization of motor skill performance, specifically the selection and precise control of delicate, finite movements may provide sufficient physiological motive to increase heart rate to a level comparable with that produced by gross motor activities performed by the same population.

The neural mechanisms of voluntary motor control are not specific to the motor area of the cerebral cortex as was once believed. It appears that various other structures within the brain share responsibility for purposeful human movement. Cortical and subcortical mechanisms participate in the creation of voluntary movement, with each mechanism performing a highly specific part in the whole functional system, (Evarts, 1973; Hutton, 1972).

Two paradigms for movement control have been proposed. the first being the peripheral paradigm which postulates that all movement patterns are the result of a stimulus-response (S-R) process. In such a process, movement control is based on serial chaining. Performance of each sub-routine of the task results in proprioception which in turn becomes a stimulus for the next response. This paradigm appears accurate in some situations, however, many movements are executed too quickly for such response produced stimuli to be useful in the execution and control of motor programs. The studies conducted by Wilson, (1964, 1968), Kennedy (1967, Cambi (1971), all cast doubt on the efficacy of this model.

A second model proposes the existence of two feedback loops operating to control motor output; a short loop controlling the immediate motor output via a series of intrinsic closed short-loop feedback systems requiring about 30 milliseconds to make modifications; and a long loop requiring about 200 milliseconds to be effective in modifying movements. When a motor program has been called upon, there is a comparison of concurrent feedback from the moving body parts with the motor program and, when needed, corrections are made without further involvement of the higher centers (Welford, 1968;

Wilson, 1964, 1968). This process only functions when the movements are slow enough to allow processing of the sensory feedback transmission. Since motor control during slow movements appears to follow an efferent-afferent (behavior-feedback) loop, modifications in programs can be made using feedback from sensory and proprioceptive/kinesthetic systems. It is because of the time needed for such a system to operate that it is termed the "long loop feedback system," (Sage, 1977).

Neuroscientists have long thought that the comparison processes of the motor program and its image or copy occurred primarily in the brain. However, Gibbs (1970) suggested that the muscle spindle and spinal cord may house a comparator mechanism whereby the motor output and a sensory copy of the motor program can be compared. Sage (1977) has suggested that the copy may cause the intrafusal muscle fibers to contract concomitantly with the extrafusal fibers. Thus, if the muscle belly contracts at the same rate and to the same degree as the intrafusal muscle fibers, the spindle afferents will not be stimulated. However, if there is a discrepancy, the spindle afferents may be stimulated to control the muscular contraction. This process may by-pass the brain completely or it may occur simultaneously with feedback to the brain. The process would be considered as short-loop feedback when the process by-passesthe brain and the fusimotor responses function as reflexes; when information from the fusimotor system supplies concurrent feedback to higher centers in addition to the reflex function, we can view this as the long-loop feedback mechanism. In either case it may result in compensatory changes in movement in the form of adjustments in effort to match the efferent copy.

There is no generic model that adequately describes the control systems that govern movement. However, all that is necessary, is to recognize that there must be a motor program of some description when rapid action is necessary; and that feedback processes are important for slow movements where accuracy and regulation are important (Schmidt, 1982). Further, the regulation and refining of motor programs involves many of the higher centers and these centers appear to have output to areas of the brain that influence the autonomic and the central nervous systems.

Severely/profoundly handicapped children may experience dysfunctions in their neurological feedback and control mechanisms. These dysfunctions result in either jerky, uncontrollable movements, or an overall increase in muscle tonus making movement difficult, if not impossible.

It is generally accepted that the performance of work results from increased neuromuscular activity. The activity itself and the humoral alterations (e.g. catecholamine concentrations) that precede and occur during the activity, serve to modulate the functioning of the cardiovascular and cardiorespiratory systems. There is confusion concerning the predominant factors influencing these systems during exercise. Fox and Mathews (1983) have implicated increased activity of the motor cortex and levels of epinephrine and non-epinephrine, as well as hydrogen ion concentration and the temperature of the blood. Although discrete movements may not be observable in severely/profoundly handicapped children, there may be sufficient motor cortex activity and/or alteration in the catecholamine levels to create significant elevations in heart rate.

The purpose of this study was to compare the heart rate responses of two profoundly handicapped children during the performance of fine motor skills and gross motor skills. The closed-skill fine motor activities were performed in the classroom, and the open-skill, gross motor activities performed as a part of each child's physical education programming.

Method

A single subject repeated measures design was used to both structure and evaluate the physiological performance measures. The utility and validity of single subject designs has been extensively addressed by Baer _et al_, (1968); Bergin & Strupp (1970); and Hersen and Barlow (1976).

Heart rate responses were recorded during the performance of closed-skill fine motor activities and open-skill gross motor activities. The heart rate data was obtained unobtrusively using a radio-telemetry device to monitor the electrocardiogram recorded from two sensors attached to the subjects' chests. The sensors were attached to the right costal margin of the sternum; and at the intersection of the mid-clavicular line and the fifth intercostal space. The radio transmission was received and demodulated in a different location from that used for the skill performance. The demodulated signal was stored on magnetic tape using a physiological recorder. Heart rates were determined for 20 second intervals from the onset of performance of each skill until the task objective was attained, regardless of the number or frequency of verbal and physical prompts (demonstrations of the motor imitation program by the teacher).

Subject I

Frank is a sixty pound, ten year old male, the single survivor of a twin pregnancy. He was born approximately eight weeks premature, with various physical and medical anomlies including; hyaline membrane disease, multiple metabolic disorders, hyperalimentation, vitamin E deficiency, pneumonia, congestive heart failure and neurological dificulties. Neurological evaluation determined the presence of increased tonus in all extremities, with the involvement in both upper and lower extremities being about equal. Motor evaluation indicated moderate spastic quadrapareisis. There was an absence of head, neck and body righting reflexes, and an absence of Landau or protective extension in any direction. Frank exhibits a 15 degree bilateral flexion at the knees due to tight hamstrings (bilateral transection of the achilles tendon has already been performed), along with bilateral hip flexion contractures of 15 degrees. Deep tendon reflexes are brisk and symmetrical throughout, without clonus or Babinski.

Activity

Two activities were selected for heart rate comparison. The open-skill gross motor activity required Frank to be placed supine on a large wedge mat (angle on inclination 25°) with his head superior to his feet; he was asked to move himself to the bottom of the mat. This was accomplished through a series of gyrations involving hip flexion. The second activity (closed-skill fine motor) was performed while seated in a wheelchair in an attempt to minimize hyper-reaction to position. While in this position Frank was asked to perform a motor imitation program consisting of the unilateral opening and closing of his hands on command. Heart rate data was recorded during both activities.

Subject II

Brian is a small (30 lb.) seven year old male who experienced anoxia for an unknown period of time shortly after birth. As result of the low oxygen levels to the brain, Brian has no functional vision, a history of recurring seizure activity, and other central nervous system disturbances. Seizure activity is controlled using 45 mg/day Phenobarbital and 150 mg/day Dilantin. Central nervous system damage is further evidenced by his spastic quadraplegia which renders him in need of assistance in performing all activities of daily living. Neurodevelopmental evaluation revealed the presence of moderate asymmetrical tonic neck reflex (ATNR) weak extensor thrust reflexes, and an absence of protective extension in any direction. Brian has normal range of motion in all joints with the exception of the knee where a 10 degree flexion contracture is present bilaterally. Although trunk and joint stability appear to be functionally developed, head control is non-existent. Evaluation of his motor development indicated that his functional gross motor abilities reflect those of a 2-4 month old infant.

Activity

Brian was asked to follow a motor imitation program consisting of a series of individual motor commands performed while in a sitting position in a sling chair. The sequence was a follows: "reach out and touch the picture, put your head down, touch the picture." The stimulus picture was held within 12 inches of his body on the mid-sagittal plane. This activity was considered as Brian's fine motor activity. The second activity consisted of Brian being placed supine on the trampoline. The instructor lifted Brian's knee until the thigh was vertical and the lower leg horizontal. Slight pressure was applied to the outside of Brian's knee, moving it over his mid line while the instructor gave a verbal cue to "roll over." The role was considered complete when Brian had rotated 90 degrees so that his cheek touched the trampoline. Heart rates were recorded for both tasks.

Results

Figure 1 illustrates the relationship between Frank's heart rates during the performance of the closed-skill fine motor, and the open-skill gross motor activities.

Insert Figure 1 about here

Although the heart rate responses to the gross motor program are higher (153 ± 9 beats/minute), the fine motor tasks resulted in heart rate values of 145 ± 5 beats/minute. Since the inclined mat activity was a gross motor open-skill, few environmental constraints were placed on the activity. The resulting intermittent work outputs is illustrated in the heart rate recordings. Times of elevated heart rates, e.g. Trial I, 20-50 secs, 90-180 secs; trial II, 70-120 secs and 160-180 secs) indicate periods of active movement, while the lower heart rate recordings reflect periods of inactivity between muscular efforts. The stress placed upon the cardiovascular system by the fine motor closed-skill activity was less than that generated by the open skill activity as evidenced by the lower heart rates. Generally, it appears that the level of work is more constant in the closed skill activity where the heart rate remained at 145 ± 5 beats per minute.

Figure 2 presents the data recorded from Brian's skill performances. Heart rates during the rolling skill reach 136 ± 6 beats per minute; heart rate elevation and recovery following the completion of the roll to the right and the left are clearly seen in the time intervals 0-50 secs and 180-220 seconds.

Insert Figure 2 about here

The heart rates observed during his motor imitation program are lower on average, but more variable than those recorded for the gross motor skill.

Discussion

Although the heart rates observed during the performance of the closed skill fine motor activities were lower than those observed during the gross motor activities, they are higher than most special education classroom teachers might expect. When we initiated our study of the physiological responses of severely/profoundly handicapped children participating in special physical education programming, we were concerned about the fragile nature of this population. We were extremely careful not to provide exercise stressors that might result in cardiorespiratory distress. Based upon the observations presented in this study, and many other observations within this population, we believe that many classroom programs introduce physiological stress at levels never before suspected.

Non-handicapped populations also demonstrate elevated heart rates when movement is not taking place, but is being anticipated. These cardiovascular changes are thought to result from activity in the motor cortex, and concomitant changes in catecholaimine levels. While this may also be true for severely/profoundly handicapped children, we believe that the heart rate changes are also mediated by muscular activity that appears to be taking place.

It we accept Schmidt's (1982) general thesis that there must be some motor program for purposeful movement, and we acknowledge that the subjects in this study performed closed-skill fine motor, and open-skill gross motor activities at established criterion levels, we must conclude that the subjects had stored motor programs with the associated feedback mechanisms. If the unconscious retrieval of information breaks down, or is innaccurate, the severely/profoundly handicapped child responds with inappropriate motor behaviors. We observed frequently that the children would appear to "forget" their motor task and exhibit inappropriate movements, cease to move, or appear to be indecisive with repeated flexion and extension of limb sequents. The range of motion of the flexion/extension movement was quite limited.

We cannot assume that no muscular activity was present because there was no movement. If there were isometric contractions of the musculature on both sides of a joint, observable movement may not occur. However, it is most likely that one muscle group (prime movers or antagonists) would dominate, if only momentarily, producing movement within a limited range.

It was suggested earlier that severely/profoundly handicapped children often experience neural dysfunctions of both efferent and afferent mechanisms. Smooth movements, and controlled states of non-movement are maintained by the spindle afferent systems and their gamma efferent fibers. Knowledge of position is also provided by this fusiomotor mechanism in conjunction with the kinesthetic receptors in the joints. If these systems were hyposensitive, then positioning errors would be detected slowly resulting in movements in excess of those required by the motor program. This would generate a condition similar to that observed in this study and in many severely/profoundly handicapped children. This hyposentive state would result in increased muscular work, which in turn would make increased metabolic demands that must be reflected in the heart rate.

An alternative explanation for the observed heart rate responses focuses on the summation phenomena of the neuromuscular mechanism. As the severely/profoundly handicapped child selectively attempts to attend to a task and organize motor responses with the appropriate spatial and temporal coordinates, the operation of the unconscious servo-mechanism or compartor is inefficient. Such an occurrence may result in the firing of inappropriate neural dischanges, which, if directed to prime movers and/or antagonist muscle groups, would create increases in neuromuscular activity, which then would result in increased heart rates.

While the activity of the motor cortex and the humoral responses associated with the activity may be adequate to explain the heart rate elevations in non handicapped children as they anticipate activity, it seems likely that muscular effort, although not easily observed, contributes to the heart rate responses of the severely/profoundly handicapped child.

Conclusions

Regardless of the acceptability of our theoretical explanation of the described heart rate responses, they do, in fact, occur. Further experimentation in this area is needed. However, the results of this study must be considered when designing, implementing, and evaluating educational programs for severely/profoundly handicapped children. It seems reasonable to propose that a fatigue factor may affect retention, causing inefficient learning, or inaccuracies, or non-compliant behaviors. If this is true, then efforts must be made to structure performance environments to allow for the recovery of students' cardio-pulmonary systems.

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Footnote

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Figure Legends

Figure 1 The relationships between typical heart rate responses observed during the hand closing fine motor skill task, and typical heart responses during the performance of the gross motor task for Subject I.

Figure 2 The relationship between typical heart rate responses observed during the fine motor imitation task and the bilateral, gross motor rolling task for Subject II.

Figure 1

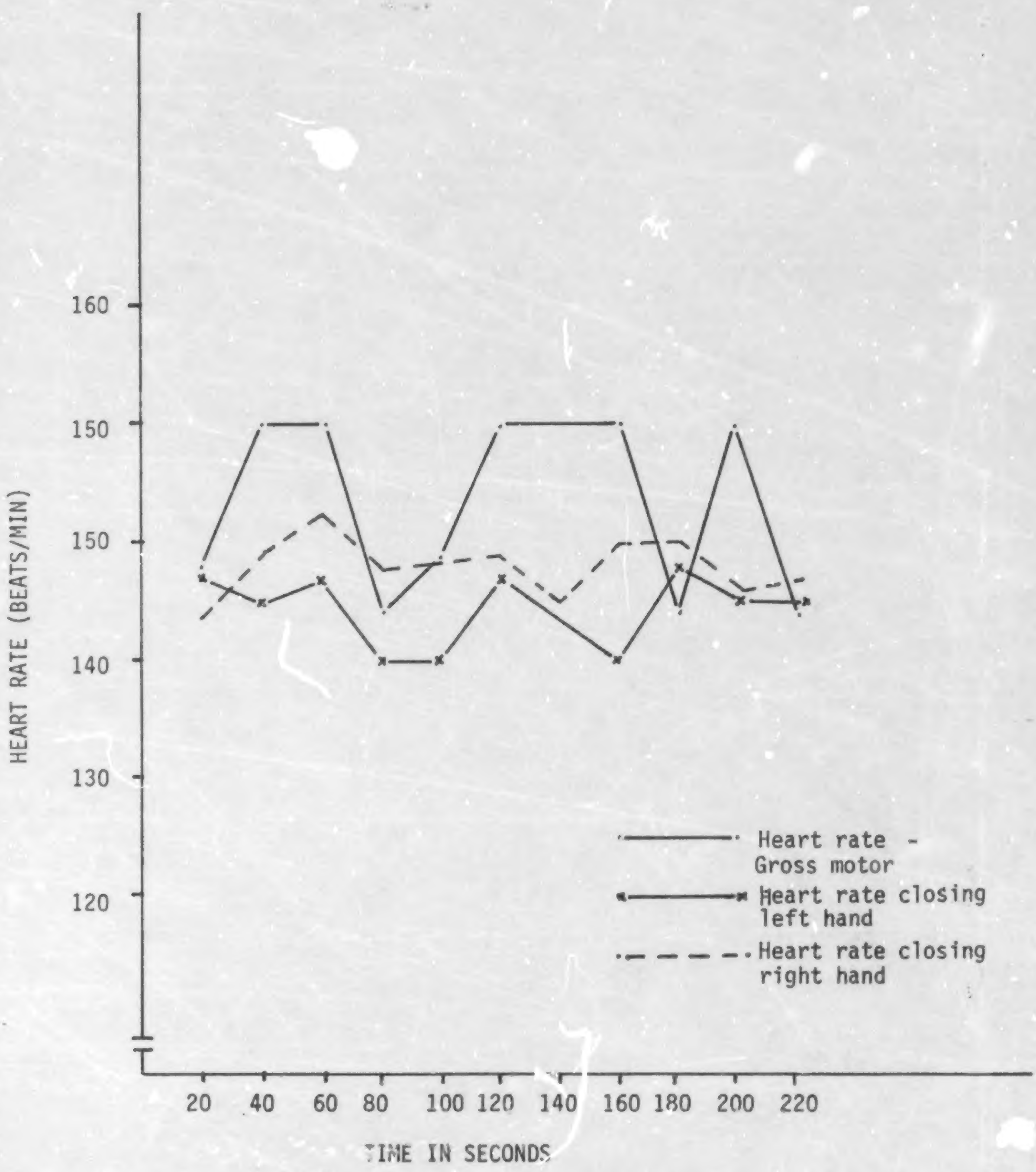
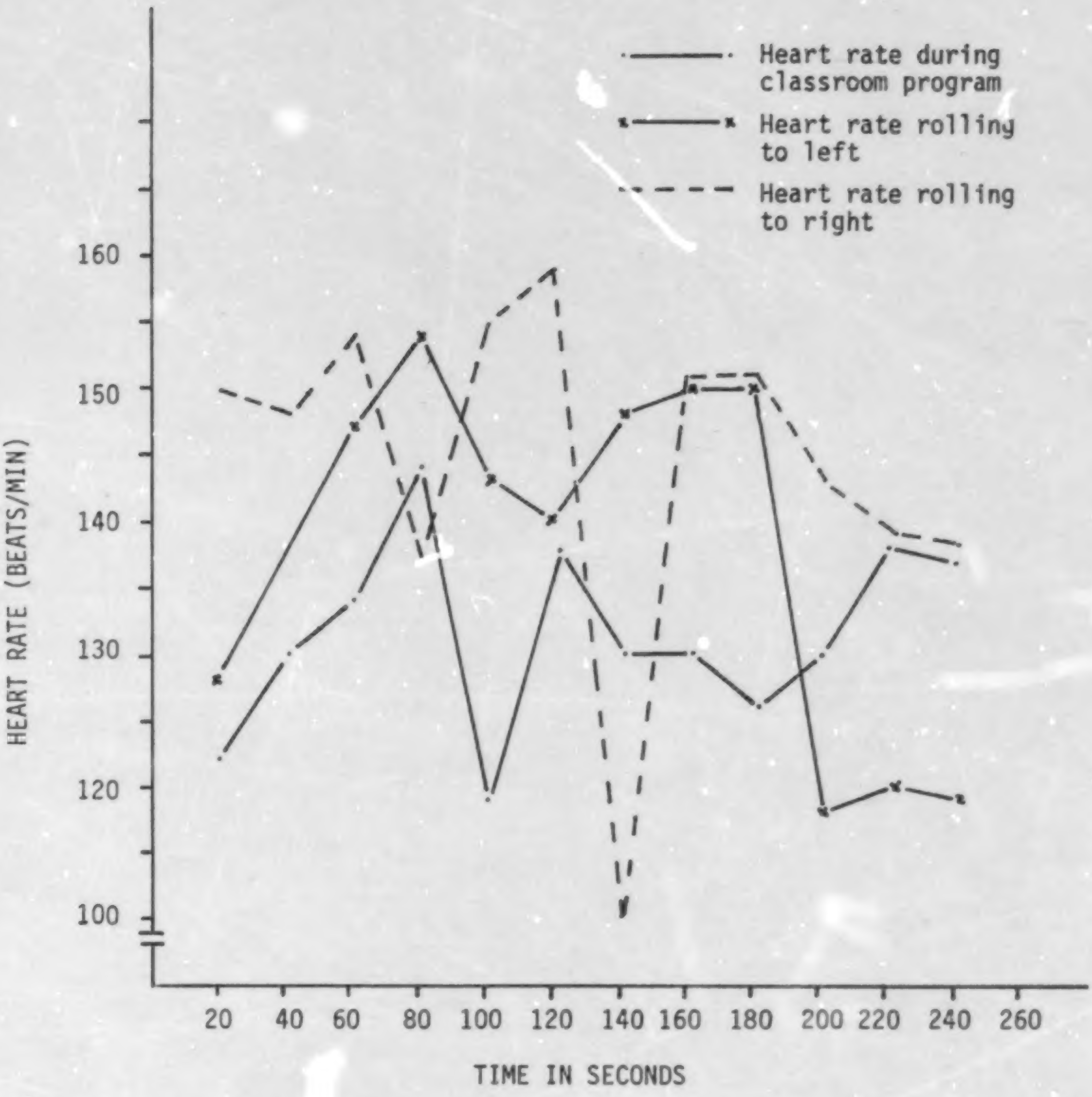

HEART RATE (BEATS/MIN)
160
150
150
140
130
120
20
40
60
80
100
120
140
160
180
200
220
TIME IN SECONDS
Heart rate - Gross motor
Heart rate closing left hand
Heart rate closing right hand

Figure 2



Heart rate during classroom program
Heart rate rolling to left
Heart rate rolling to right
HEART RATE (BEATS/MIN)
160
150
140
130
120
100
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME IN SECONDS